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EDITORIAL

DILUTING THE FORESTRY EFFORT

EVER SINCE the so-called farm problem was thrust into "front page" prominence it has been injected also into forestry. At one time foresters took meticulous care to limit their demands for forestry practice only to lands not ordinarily suited to agriculture, and it was assumed that agricultural lands still covered with virgin forests merited no attention of the forester since they were expected soon to be put to agricultural uses. Now, however, we are told that we already have too much land in agriculture, and a growing number of foresters are suggesting that submarginal farm lands should be returned to forests. Thus, in effect, forestry is being advanced as a remedy, partially at least, for the plight of agriculture. The abandoned farm problem has already been called a forestry problem, *i. e.*, the land should never have been taken from the forest.

Farming and forestry offer many interesting parallels. Submarginal farm lands in most cases became such only because of changing economic conditions, yet at one time they supported farm families in comfort and plenty. Changing conditions are forcing the production of our food supplies by more intensive methods from a smaller acreage or are making available supplies from distant regions. If a greater area is cultivated than is needed a surplus results, with less profit for all and poverty for many. Similar conditions have affected the practice of forestry. Imported lumber and pulpwood compete with our own. Reduced needs for wood make a smaller area of timberland sufficient if, like in agriculture, the best of it is handled intensively. With no such selection only the most extensive methods must prevail on the total acreage with consequent loss of profit to all engaged. If submarginal farm lands are taken out of agriculture and put into forestry the farm problem is doubtless alleviated but the forest-growing business at the same time is not strengthened. Certainly it would make the private timberland owners' problems that much more acute since most of them have land that is of marginal character even for forestry. Submarginal

farm lands as a rule are far superior for forest growth than a vast amount of private land still under forest and which has never seen a plow; furthermore the cost of planting them, the delayed returns and the uncertainty of results from planted forests puts the burden of their afforestation upon the state, and in turn makes the public still more a competitor of the private owner. It is hardly proper for the forester to say what should be done with farm lands taken out of farm-crop production.

With so much timberland already producing trees and all of it so sorely in need of better fire protection, some silvicultural effort, tax relief and other encouragement, it hardly seems wise to further dilute our forestry effort by forcing additional acreages into forestry. Certainly, from the standpoint of needs for timber we do not need more land in trees, but a better handling of what is already so occupied.

In agriculture we can practice farming profitably on only a limited proportion of our arable land while on most of what remains it isn't worth the effort. The case is similar in forestry. Anyone who travels through the forested regions and is duly observative must be impressed with how much forestry can be practiced at one place and how little can be practiced at another. We have submarginal forest land just as we have submarginal farm land.

In farming it is the surplus that makes the problem. The same can easily happen in forestry, perhaps not so much as to output as to the area over which the effort is spread. The public purchase of submarginal farm lands for forest purposes may be effective in reducing the farm surplus but if it increases the forest surplus at the same time and dilutes our forestry effort, the expected substitution of "paying forestry for poverty farming" would be defeated from the start.

THE LITERATURE OF FORESTRY

By HENRY E. CLEPPER

Pennsylvania Forest Research Institute, Mont Alto, Pa.

This is a timely and critical estimate of the quality of American forestry literature, particularly as to its literary style and scientific perfection. The author finds much to commend and more than a little to criticize. He mentions by name some of the forestry authors who have exhibited the knack of presenting their material in an interesting and finished yet forceful style. To promote higher standards of writing among foresters he proposes a Society committee to pass upon each year's literary output and to award a prize for the most meritorious.

WHEN considering the literature of forestry we must keep in mind not only the technical writing on the subject, but also the popular and so-called semi-popular writings. Although American forestry among the professions, arts, and sciences is a mere babe in years, yet during its lusty infancy there has grown up an enormous quantity of printed matter, bearing directly and indirectly upon it. Foresters generally have been so preoccupied fighting the battles of forestry and so concerned with what we may call the salesmanship of it, that the mass of literature which has accumulated is not so much the result of a deliberate attempt to evolve that literature as it is a sort of incidental accompaniment to the principal job of "putting forestry across."

Forestry has won for itself a recognized position among the professions; at the same time it is a subject with a tremendous sentimental and popular appeal to thousands. It is not too much to affirm that the status and support forestry has achieved have been won by those older, pioneering foresters of three and four decades ago who understood this nation's need for forestry, and, what is more important, had that rare ability and genius to be able to write about it and make it plain to the man in the street. I speak advisedly of them as geniuses for, as William McFee says, "only genius can interpret science to the non-scientific." Those early leaders, Fernow, Hough, and others, broke the frozen, rocky soil of indifference and in the *American Journal of Forestry* laid the foundation on which was builded a native forestry literature.

The *American Journal of Forestry* was born in September, 1882, and died, as a publication, in October, 1883. A forester, interested in the literature of his profession, can obtain no better conception of its historical and cultural background than by reading the articles and notes of that 600-page volume.

"Three principal causes exist why forestry is still so backward: first, the long time which wood needs for its development; second, the great variety of sites on which it grows; thirdly, the fact that the forester who practices much writes but little, and he who writes much practices but little." The foregoing statement was written by that grandmaster of forestry, Heinrich Cotta,

at Tharandt, December 21, 1816. It still applies in some respects today in this country, but on the whole American forestry has been fortunate in that it has had practitioners who have attained eminence both as practical foresters and authors.

If the present writer attempts to evaluate some of the distinguished authors in the profession, it is done, let it be understood, in the spirit of one incurably addicted to literature in general and to the literature of forestry in particular.

In the realm of writers on the subject of research no one, it is believed, will dispute the preëminence of Raphael Zon, perhaps the most indefatigable and copious writer in the profession and as fresh, inspiring, and enthusiastic today as he was twenty years ago. Who has done so much to stimulate young practicing foresters to acquire knowledge of the economics of forest research?

A student of English literature, going back to sources, begins by pondering and later by enjoying Chaucer and Shakespeare. A student of the literature of American forestry begins by attempting to conceive the problems that so concerned Fernow, Hough, Rothrock, Sargent, and Roth during the concluding decades of the last century, and eventually finds himself deep in the style and shrewd logic of these giants of the profession. All, with the exception of Professor Roth who was not without literary defects though he exerted great influence, were faultless writers in the expository traditions of that age, and any young forester will profit who reads their rich, cadenced sentences.

Gifford Pinchot, who in the beginning wrote as their contemporary, somehow suggests a writer projected into the faster, terser, journalistic present day. His early articles and books even now read as if they had been evoked from the finished and polished style of the feature writers of the metropolitan press. This does not imply a lack of scientific accuracy; quite the contrary is the case. His works were scientific without being dull; controversial without being obscure; forceful without being sensational. Evolved from the best traditions of the cultured and gentlemanly style of magazine writing of the last quarter of the 19th Century, his works remain modern because good craftmanship, regardless of age, is always new.

No record of the literature of forestry would be complete without mention of the excellent, semi-technical series of articles written by P. S. Lovejoy for the *Country Gentleman* over a period of years. The stimulus to farm forestry, brought about as a result of these articles in one of America's most widely read rural magazines, may never be known, but it was undoubtedly great. Writing, such as his, not only enriched the literature of the profession, but immeasurably stimulated the practice of forestry among a group greatly in need of it and most certain to benefit by it. It is to be deplored that a selected collection of these articles was not brought out in permanent book form.

So far we have dealt with books and magazine articles, and it is time that mention were made of the forestry editorial writer. For years anything said editorially about forestry was written

by newspaper and magazine editors with the conservation viewpoint, but without the forester's practical training. Once the most powerful and influential form of journalistic writing in the country, the editorial has in recent years become almost non-existant as a force in public life. A new era in forestry began when Ovid M. Butler assumed the editorship of *American Forests and Forest Life*. His engaging and militant editorials in that publication have been of the highest honor to the profession, for they have always been characterized by forcefulness, sanity, and charm.

Writers there are in plenty who have contributed popular and technical articles and books to the literature of forestry, but only a few foresters, among whom are E. G. Cheyney and Tom Gill, have successfully essayed the field of fiction. The latter, an author of scientific accuracy when writing on scientific subjects, is perhaps the first forester to attain distinction in adult fiction. His short stories have been appearing for several years in various magazines; those published in the *Cosmopolitan* have been marked by a typically virile style and high literary quality. If there is one writer capable of giving the forest ranger a definite place and personality in literature, that person is Tom Gill.

A conscientious compiler could list within the forestry profession many authors whose writings may serve as prose models in English composition. Immediately names spring to mind: Will C. Barnes, E. I. Kotok, Aldo Leopold, Paul G. Redington, S. B. Detwiler, Samuel N. Spring, Henry S. Graves, Austin Cary, John D. Guthrie, Burt Kirkland, Ellwood Wilson, E. N.Munns, R. S. Hosmer, Ward Shepard, Theodore Woolsey, Clifton Howe, R. T. Fisher, George H. Wirt, S. T. Dana, Hugh P. Baker. Invariably when one of these men has something to say it can be depended upon that he will say it well.

There are many others whose writings are marked by a conscious attention to the accepted standards of English usage and whose statements are adorned and therefore strengthened by individual styles and mannerisms. Consider, for instance, the writings of Dr. C. A. Schenck, perhaps our only cosmopolitan forester, who can be the most charming of disputants when he does not choose to be the most acidulous. Note the effects he produces by his deft use of hyperbole, satire, and, occasionally, asperity; then try to realize that he is writing an alien language and perhaps struggling with an alien idiom. Whatever his contributions to Continental forestry, he has unquestionably enlivened the literature of American forestry.

There has never been a dearth of popular books on trees, written usually from the viewpoint of the nature lover. Many of them have been charming, but too often they have been mere gush. Why is it that the ordinary lay writer, contemplating trees and nature, must affect sentimental attitudes? Does it necessarily assist in an appreciation of trees to personify them and read into them human attributes which they do not possess? All the printed platitudes and sentiments about trees are designed solely to produce a conviction in the reader's mind that the author finds trees

beautiful and loves them. Well, who doesn't? An observer, examining some of the saccharinities periodically written about trees, can understand and sympathize with Theodore Roosevelt when he designated a certain class of writers as nature fakers. It is unfortunate when foresters are tempted to perpetrate similar asininities. As Recknagel and Spring succinctly say in their excellent book, *Forestry*, "Forestry is oftentimes the victim of its friends."

Book reviewers in other professions do not hesitate to say a piece of writing is bad or inaccurate when such is in fact the case. If foresters generally are to develop a jealous regard for their profession, why should they hesitate to denounce slovenly work as well as commend that which is good? How else can there arise a dignified and distinguished literature of forestry? It is not because examples of literature unworthy of the profession do not occasionally appear. Consider the example of *Forestry For Profit* by Theophilus Tunis, brought out by Putnam's in 1923. The dross in this book entirely obscures its few good points, yet it is given an honorable position in most libraries beside worthy works on woodlot and farm forestry. And there are others.

A few years ago appeared a useful book, in the form of a compilation, that supplied a very definite need in the field of forestry. One chapter, however, was so remarkable for its awkward and ungrammatical construction that it marred an otherwise highly creditable piece of work. When a second, revised edition appeared the same blemish was allowed to remain, and what should have been a distinguished job of craftmanship is merely another piece of hackwork. A valid enough excuse, no doubt, would be to say that this is a technical book and the publishers made no claim as to literary quality. But why should the technical writer be exempted from the generally accepted stipulation of all authorship, namely, that he should first know how to write?

After a fairly comprehensive examination of many technical forestry books, the present writer wonders whether the authors have not deceived themselves into thinking that literary merit will reduce the value of their productions as textbooks. If it is true that the ability to write cannot be acquired by learning but must be absorbed, it is obvious that a well-written textbook placed in the hands of a forestry student serves a two-fold purpose.

There is current within the profession, especially among those laboring in academic halls, a half-resentful feeling that technical books on forestry are not wanted by publishers, that textbooks on forestry invariably fail financially. In support of this statement foresters will point to the large number of technical works privately printed, usually at the expense of the author. The present writer has no inclination to argue this phase of the matter, for he has the warmest sympathy for the man, who after perhaps years of meditation and hard work, produces technical manuscript only to have it politely rejected time and again by reputable publishers. It may be permitted, however, to quote another technical writer, one whose specialty is marine engineering, who "is certain that when the authors of technical works devote as much at-

tention to the literary side of their productions as do the publicity experts who write automobile and breakfast food advertising, the sale of textbooks will increase to an unprecedented degree."

No one but an incorrigible purist would expect practical foresters to write with the literary style of Henry S. Canby or the late Stuart Sherman. Yet nothing is truer than that the standing and reputation of a profession is measured by its literature. If forestry is to take the place among the arts and sciences to which all of us feel it is entitled, then its permanent literature must reflect and not obscure professional achievement.

Toward the end that literary as well as professional distinction may be suitably recognized and encouraged, the suggestion is respectfully offered that there be created within the Society a committee, which shall adjudge current forestry literature, and which on behalf of the Society shall award an annual prize or certificate of merit to the author of the book or other literary production that best represents scientific accuracy and excellence in letters.

Foresters, like other professional men, must have standards by which to measure themselves, their work, and their contemporaries. Malicious criticism will get us nowhere, but neither will a complacent acceptance of the "modern craze for swift results, quantity production, and a corresponding reluctance to have our botched and hasty performances compared with the indestructible products of a more leisurely age" enrich the literature of forestry.

PUBLIC RELATIONS
WHAT HAVE WE BOUGHT AND WHERE ARE WE HEADED?[1]

By WALLACE I. HUTCHINSON[2]

Assistant Regional Forester, San Francisco, Calif.

In this very able presentation of public relations work the author shows vividly its proper place in forestry and that as a field it is not given the backing it deserves. He calls the attention of foresters to the necessity of winning public understanding and appreciation of their ideas and plans before they can expect public support. Efforts toward more popular acceptance of forestry are rendered impotent if public sentiment is not built up first. The author believes that the failure of foresters in private forestry is due largely to the wrong public relations methods used to sell forestry to lumbermen.

PUBLIC RELATIONS, as we understand it today, is a relatively new enterprise in America. In fact, even a decade ago the term was little heard of, and even when heard and known carried a vague significance in the mind of the general public. For the most part it was connected with the ulterior publicity and propaganda efforts of the old-time press agent, and, unhappily, this same idea still prevails to a marked degree among those who do not understand or appreciate its true meaning.

Public relations has been defined as "the process of finding out, and of making known, the factors of an enterprise which are of public interest". For forestry this means: "To stimulate public understanding and quicken public interest in forestry problems so that there may be nation-wide support for the practice of forestry principles". That is the broad view of the job which is made up of a large number of component parts.

The necessity for the correct understanding by the public of any enterprise and the importance of public backing was well emphasized by Abraham Lincoln in the following language: "Public sentiment is everything. With public sentiment nothing can fail; without it, nothing can succeed". Every one who has followed the vicissitudes of the forestry movement through the past 30 years knows only too well the truth of these words.

Many people have the idea that public relations work, and the public relations of forestry in particular, is a relatively new endeavor. While this may be true in the United States, it is not so in many other countries where forestry practice has been in vogue for many centuries. In this connection, I have been trying to visualize in my mind just who was the first public relations man in forestry. Was he an American, a European, a forester or a layman? As far as I can discover, the first man who publicly preached the

[1]Presented before California Section, Society of American Foresters, at Berkeley, Calif., November 28, 1930.

[2]In charge of public relations, California Region, U. S. Forest Service.

"gospel" of forestry was none of these. He was the prophet Isaiah who lived in the 8th Century, B. C. From his knowledge of forests and forestry and his use of forest terms in his teachings he has been well called the "Roosevelt of the Holy Land". Joel, the Hebrew prophet of the 5th Century, B. C., was even a greater public relations man than Isaiah, and the outstanding watershed protection and fire prevention advocate of Bible times. It was Joel who, by implication if not in actual words, originated our present day fire slogan — "Prevent Forest Fires — It Pays".

Coming now to our own country and the stirring early day clashes of conservationists with the enemies of forestry, we find a number of men who, although the records do not so state, must have done yeoman service in public relations. Among these may be named Secretary of the Interior Carl Schurz, a forester at heart who was born and raised in a forestry-minded country, and his able assistant Gen. James A. Williamson, Commissioner of the General Land Office. The ardent support of the cause of forestry by these two men is written in clear and stirring terms upon the records of that administration. Who can say how much personal and public relations work had to be done by Secretary Schurz to induce President Hayes to present to Congress in his first message recommendations "concerning the depredations committed upon the timberlands of the United States, and the necessity for the preservation of the forests." This initial action resulted, in 1878, in the introduction of a comprehensive forestry bill in Congress, which stands out prominently as a landmark in the conservation movement in this country. Like honors for effective public relations effort can also be paid to many other early day foresters, legislators, teachers, and public spirited citizens and organizations.

To present day foresters the outstanding public relations movement of our time was the "selling" of conservation in all its important phases to the people of America by the founder of the present United States Forest Service,—Gifford Pinchot, one of our first government foresters and now the Governor of Pennsylvania. In this work he was most ably assisted by that renowned friend of forestry, President Theodore Roosevelt. The magnitude of this undertaking—to turn America into a conservation and forestry-minded nation—the effective means employed, and the battles fought and won mark this campaign as one of the most effective public relations effort in the history of forestry in the United States. All honor to the men who blazed the first trails through the forests of public indifference!

Gifford Pinchot did not have the radio and motion pictures to aid him in his campaign, although he did use almost every other present day public relations medium. If the lessons learned at that time, as to the need and value of right public relations and good will, had been seized upon and followed up, I feel confident that through the public understanding and support thus created the forestry problem today would be far ahead of its present position on the road to suc-

cess. But this opportunity to further mould public opinion to the cause of forestry was passed by, public relations work was placed in the category of "propaganda" and tabooed, other movements stepped in to take its place, and forestry was lost in the shuffle.

Any great movement, such as forestry, in which national and state governments and private interests play an important part, must depend on public rather than scientific support. Congress and state legislation move slowly unless the urge for action comes in no uncertain terms from the voters. Such popular demands, however, are not so often based on knowledge and logical deductions as on mob psychology. It is not surprising, therefore, to find that when the science of forestry was overemphasized, as it was in the early days of the profession, the public failed to comprehend what it was all about and consequently gave scant attention or support to the movement.

That these facts were known and recognized is proved by the early reports of government foresters who, more than 25 years ago, stressed the need for "an active campaign of popular education." But little or nothing was done in the way of a follow-up to these suggestions. Foresters still continued to talk and write in terms that the ordinary layman could not understand, and the whole subject took on such an academic aspect that the "man on the street" never saw the forest for the trees. He may have been startled by the repeated cry of "timber famine," but as long as the lumber yard around the corner was well stocked with boards he worried little. That perhaps is the one great fault of all of our forestry public relations work, past and present, —we have never made it an intimate and personal problem in the life of the average citizen.

It was not until about 1915 that foresters awoke to the fact that public education and public understanding was an important part of their forestry work. That year marked the writer's first official contact with public relations work, when he was called to the Denver headquarters of Region 2, by the then District Forester Smith Riley, and placed in charge of the office of "educational information." Later, in 1920, the Branch of Public Relations was established in the U. S. Forest Service. Four years after came the first determined drive for a national forest policy, which resulted in the passage of the Clarke-McNary Act of 1924.

While this was by no means the first important forestry legislation passed by personal and public relations effort, it did mark a new step forward in that, in this particular case, the people at large were afforded a clear understanding through public relations mediums of the aim and purpose of the Act, and were thereby able to give it intelligent and helpful backing. Like publicity and effort have been successfully used in the case of the McNary-Woodruff Act, the Englebright bill now before Congress, and many others.

The important point in all this, to my way of thinking, is the tardy recognition of the fact by those interested in forestry of the necessity for public understanding, appreciation, and support in the final solution of the forestry problem. The forester has finally

come to realize that people are not given to beating a path to his door to worship at the shrine of forestry, but that if he is ever to "sell" his wares he must preach the gospel of forestry from the housetops that all may hear and understand.

Look back over the history of the Forest Service and you will see that the greatest progress has been made not in times of peace and contentment, but in those stirring days of controversy when the limelight of publicity was turned upon this government organization and it was subjected to a barrage of criticism from all sides. Then it was that we learned the sterling worth of our friends and supporters, and the value of public relations activities in bringing the true issues to light. By these "battles" the Forest Service grew in public esteem and prospered—without them it would today be "just another government bureau".

Let us now view the public relations work of the Forest Service, with which the writer is best acquainted.

Ten years ago the Branch of Public Relations was born into a skeptical forestry world. Many said the child would not survive, and for a number of years, due to insufficient financial nourishment and inadequate attention, it seemed as if this prophecy might come true. But "PR", as the babe was nicknamed, found many friends outside and a few inside the forestry circle and continued to thrive. It is only in very recent years, however, that this "little orphan" has been given a regular place at the table and allowed to dip a spoon into the appropriations porridge bowl. Now the family even views little PR with tolerance, and often extends a helpful hand when he stubs his toe.

What would we think of a big national business organization with headquarters in nine large cities, East and West, that never called together its publicity directors to map out a sales and advertising campaign? Yet that is exactly what has happened in the case of Public Relations. The men in charge of this work, which is steadily growing in volume and importance, have never yet met in a body to formulate a program of activities, exchange ideas, or to even tell what they have done or are planning to do. Each PR man works on his own initiative, under the guiding hand of the Regional Forester of his particular region, but with no connection with his brother PR officers in other national forest regions, and with little supervision from the Washington office. With such a system, is it to be wondered at that the results secured are "spotty" and often far afield from the desired goal?

Lack of personnel and appropriations have long been a serious handicap to efficient PR work. Also, we have not yet entirely sold public relations to the men of the Forest Service. Generally speaking, it may be said that the forest ranger knows more about public relations, appreciates it more, and does more of this activity than many of the men in the more important positions. The lack of interest in public relations within the organization itself is one of the most serious handicaps this activity faces.

By and large, foresters, and especially technically trained foresters, are poor public relations men. Love of

mountains, forests and solitude are inherent in their make-up. If they did not possess these qualities they would not be true to forestry tradition. Most foresters like to travel alone, to shun crowds, to think much and say little, to read and study. All these are admirable traits, but some of them are not very conductive to successful public relations effort, especially in this 20th century. Many men in the forestry profession, government, state and private, seem to live and think in a background of ten to twenty or more years ago. They secretly abhor or openly decry that which is new and progressive, or fail to appreciate its real importance and worth. If they happen to hold a position of authority, they impart these ideas to the men under them. These under officers, being by nature largely a reflection of their superior, further implant his views and likes and dislikes to the men under their charge. To this fact, probably more than to any other, can be traced the lack of progress in public relations in many localities.

Another type is the man who thinks public relations is the job of the specialist, that it does not enter into his particular activity of business, and that it is more or less of an imposition to be called on to engage in such work. Such a man usually knows little and cares less about public relations, or considers himself unsuited for the work without ever having given it a fair trial. Consequently when a demand for public service arises he seeks the easiest way out—by "passing the buck."

The third type is the forester who is alive to the value of good public relations, whether it be with the business man, farmer or tourist, and who seizes every opportunity to "put over" a worthwhile message and to build good will for the organization or cause he represents. This man may never make a public speech or write a bulletin, and yet do more for the cause of forestry than one who is accomplished in these lines. It is this kind of personal man-to-man public relations that is particularly stressed by the Forest Service in California, since it is believed to be the most effective kind of PR work that field men can do. Such individual effort may seemingly accomplish little, but like the constant dripping of water on stone it ultimately exerts a powerful influence in helping to solve many knotty forestry problems.

Strange but true, the greatest impetus to many important forestry movements has come not from the foresters themselves but from outside individuals and organizations interested in conservation. As foresters and as an organization we are much more given to arguing and passing resolutions than we are to overlooking petty difference of opinion and putting our shoulders to the wheel for the common good. This, of course, is not true in all cases or in all parts of the country. But review the history of our own Society and enumerate the number of times that foresters, as a body, have played an outstanding part in the passage of important legislation, or the solution of pressing forestry problems. The results will surprise you, and perhaps point to the necessity of greater cooperation, as well as action by one and all of us in the public relations of forestry. Perhaps this lack of initiative

has been due to the rather "exclusive" character and small size of our organization, with men widely scattered and many in federal or state service where undue activity, especially in connection with legislation, is frowned upon or forbidden. It is to be hoped that the opening of the doors of our Society to new and young blood may help to broaden its scope of usefulness in public service.

Forestry and related activities have prospered mightily in the United States in the past 25 years, and in this progress public relations has played its part. We have 150 million acres of national forests created for the use and enjoyment of our citizens. Forty-one states have foresters or forestry commissions, most of which coöperate with the federal government in fire prevention and other forestry activities. Twenty-three of the important colleges and universities of our country maintain forest schools that turn out hundreds of foresters yearly. Forest experiment stations have been established in all of the major regions of the country. Steady but sure headway is being made in the solution of the nationwide fire problem. The area of state, county and municipal forests and parks has grown to many millions of acres. Lumber companies are taking an active interest in forestry practice, fire prevention and reforestation. Congress is showing a keener appreciation and a more helpful attitude toward the passage of forestry legislation and appropriations. Conservation, fire prevention and forestry organizations are growing in number and importance. The press of the land was never so favorable to forestry as at the present time.

But let us take off the rose-colored glass for a moment and view in the bright sunlight a few of the outstanding forestry problems in which public relations is particularly concerned.

First: Have we really "sold" forestry to the American people? The answer to this, as we all well know, is most emphatically—No! Out of the 122 million people in the United States at least 95 per cent have no conception whatever of what forestry really means. Of the remaining 5 per cent, probably not over 1 per cent have an intimate knowledge of the problem. This, of course, is only a guess, but I am not so sure that the estimates given do not lean heavily on the side of forestry. If you wish to convince yourself that people do not know about forestry, just mention the subject and say that you are a forester to the man you meet on the street, on the trail, or elsewhere—the business man, farmer, irrigationist and sportsman—and note his reaction. Or, review the history of conservation and forestry organizations and associations in America, and you will find that their membership is numbered in thousands, not hundreds of thousands as it should be, and that they have been compelled by popular demand to feature animals, birds, flowers and like nature subjects in their publications, rather than forests and forestry, in order to maintain a satisfactory circulation. I grant you that many people know something about trees, fire and kindred subjects, but to those who live apart from forests and mountains the idea of conservation of natural resources is often like

that of the man who said he had aided the cause of forestry by killing woodpeckers.

In the early days we preached tree conservation and the beauty of forests instead of the practical and economic side of forestry. So today when we cut timber, even under tried and true forestry methods, the public in many localities see only the stumps and shout to high heaven that we are forest devastators. We talked of European forestry practices and the planting of a tree for every one cut until many people even today think that reforestation is the only solution of the forestry problem. We cried "timber famine" so long and loud that we almost grew to believe it ourselves, although we knew all the time that in reality this was largely a catch phrase. And there are many other like incidents where foresters have stepped off with the wrong foot and lived to regret it.

Possibly one reason for this lack of knowledge and understanding of forestry by the public is due to the "hill and dale" methods of publicity and public relations we have practiced. We put on a big drive for some worthy objective for a week, a month, or even six months, and then we rest on our oars for the remainder of the year. Sometimes we use a shotgun to achieve our objective when we know we should be using a rifle, and a high-powered one at that, to hit the bullseye. American Forest Week and many other of our activities are good examples of what is meant by "hill and dale" public relations work.

Second: What has been said about "selling" forestry to the public also applies to fire prevention. No one will question the fact that we have made progress in fire prevention, but the results attained are nothing like what they should be considering the length of time we have been on the job. For a civilized country the number of forest, brush and grass fires in the United States is appalling. Despite our best efforts in fire prevention education and fire control methods we are, considering the whole United States, just about holding our own in protected areas, both in the total number of fires and the number man-caused, while in unprotected areas the acreage burned and the resultant damage is steadily increasing. In our educational efforts we find that practically everyone agrees that fires are harmful and unnecessary, and should be prevented, but we have not yet solved the problem of implanting these principles in the public's sub-conscious mind so that people will automatically exercise care with fire when in the woods. Much of this failure to secure wished for results is perhaps due to our method, or lack of method, in dealing with the public.

Take our fire sign efforts, for example. Two or three high salaried men spend time and thought in working up a good fire prevention sign, and then we send it to an inexperienced fire guard or warden to post where he pleases. Did anyone ever stop to consider who reads these signs—whether an American, an Armenian or a Mexican—many of whom do not even speak English, let alone read it? Have we ever scientifically worked out the right size and color for a fire sign under given travel conditions—how large the letters should be, how high the sign should be

placed above the ground, and where it should be posted for the best results? Still we rub our eyes in amazement when we find a man smoking in a well posted "closed" area, or building a fire right under a tree on which there is a sign saying that camp fires are prohibited. Business firms spend hundreds of thousands of dollars in studying the technique and best methods of reaching the public through advertisements. Yet we foresters, faced with a yearly fire loss bill of millions of dollars rarely give these factors a passing thought.

We conduct extensive and sometimes expense educational campaigns against "light burning" and incendiarism, and are greatly surprised to find that in spite of favorable local sentiment and large attendance at shows, the number of such fires fails to show any material decrease. We expect education to do the whole job, when we know from many years of experience that it must be supplemented by the strong arm of the law if we are ever to make headway against these pernicious practices.

In our publicity work we seek the easy way, that will bring the greatest return in column inches, by featuring the news that the papers like to print,—fire, money receipts and expenditures, all forms of reaction, wild life and the like. We have done this for so many years that now when we release scientific news and facts on important forestry and allied subjects, nine out of ten editors consider it poor copy and throw it into the wastepaper basket. In the PR office in San Francisco we have been conducting a study of press clippings for nearly a year to determine what papers in California publish our news releases, what kind of news they prefer, and why the small country papers pass up our material entirely. This work is not yet completed, but we have already found some interesting facts. For instance, we have discovered that purely scientific material, if clothed in interesting garb, will get space in the papers, and that condensing long stories to items 5 to 10 lines in length insures their publication in many papers of small local circulation that never before ran forestry news.

Third: What about the practice of forestry by lumbermen? Have we really made as many "converts" as the lumber industry would have us believe?

The answer to this, I believe, is both "Yes" and "No", depending on how you view the term "practice of forestry". In fire prevention on going timber operations and virgin forest land substantial progress has been made, reforestation has come strongly to the fore, and "selective logging" has become the by-word of the industry from the timberland owner to the whistle punk. But despite all this, the fact remains that after seven years of coöperative effort under the terms of the Clarke-McNary and McNary-Woodruff acts less than five per cent of the timberlands in private ownership are under any form of forest management.

What is the matter with our teaching of forestry practices to the men of the lumber industry? We have made progress in silvicultural practices and management methods on government timber sales, but why do not the lumbermen follow this lead? Is it possible that many of the "refinements" we pro-

pose are not based on sound business principles, or that we have not convincingly proved the workability of many of our proposed changes in logging and mill practices?

To my way of thinking we have used the wrong public relations methods in trying to sell forestry to the lumberman. For a good many years foresters have been prone to give him a black eye and jump on him, so to speak, and then stretch out a friendly hand to help him up. We have painted him as the despoiler of our heritage of forests, creator of idle and burned acres, a menace to the cause of forestry, and at the same time we have been seeking to be friends with him and trying to induce him to put into effect certain woods practices which we believe to be essential to the right solution of the forestry problem of our country. Small wonder then that the lumber industry has retaliated with a publicity and educational barrage that has seemingly convinced a goodly number of our citizens, and many forestry and conservation advocates, that the lumbermen are doing more than their share in forestry practices and that there is really no pressing timber problem to worry over.

In the nearly 30 years of my forestry experience great changes have taken place and I look for even more and greater things for forestry in the future. But I firmly believe that this progress will not come until we radically change our method of attack, and particularly our public relations efforts. We have been like a ship floating with the tide, here today and there tomorrow, and often headed for the rocks. It is high time we made sail and steered a true course for some port. But first we must all agree what and where that port is, and then lend a hand to help reach it.

If public relations plays such an important part in the solution of the forestry problem, and the consensus of opinion today is that it is closely tied in with the job, then we should go about PR work with plan and method, and this plan should be of national scope and not confined to anyone particular region. Public relations planning for such a job will require years of work and much study, and will be continually changing to meet varying conditions. But once we know what we want and the methods we are going to use to attain our ends, we should go about it in a business-like manner. Adequate personnel and money will be required, but more important yet will be the help and backing of every forester, citizen and organization that has an interest in forestry.

Great movements and campaigns the world over, and especially successful ones, are usually tied in to some outstanding personality. But we have no such man in forestry—at least I know of none who would be willing to be so aggrandized. So we must fall back on other methods whereby to interest the public and win their confidence and support. In dealing with the public at large it will be mostly a job of salesmanship—tying in their interests with ours and through these interests gradually selling them the forestry idea. With the lumbermen, graziers, water users and the like, it will be a matter of coöperation and demonstration—and if that fails probably some form of fed-

eral or state control. In all this we must build well and on a firm and business-like foundation, for if these outside interests should some day enter wholeheartedly into the forestry game, it might not be long before their thoughts and practices would largely dominate the situation.

Today we are wrestling with the solution of the forestry problem in the United States and looking for a feasible plan of action under which all the many and varied interests will join. In practically every plan proposed education is listed as a part of the picture, but like the artist's name on a great painting it is hidden away in a dark corner. No plan that we may adopt, however worthy, will ever succeed unless the public understands and approves it, and that understanding and approval will not come through resolutions, memorials or laws, but by education, publicity, and like mediums of action. When that day does arrive, public relations will be accorded rightful recognition as one of the basic factors essential to the solution of the forestry problem of the United States.

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"If forests bring health to men's bodies, they also bring beauty to their spirits. A people will not tolerate the absence of beauty from its common life forever. Sooner or later the absence of beauty from the life and work of men, indoors and outdoors, will bring a bitter and revolting spirit. Our machine age was, for a long time, the foe of beauty. Lately it has turned friend to beauty. In all the articles and machines the machine age is making now, a desperate effort is made to make them beautiful as well as useful. It is only a question of time until the common things we use indoors will be generally beautiful. The next step is to make outdoors America everywhere beautiful; and if we do, our efforts will bear fruit in the character of our children's children".—(From *American Forestry.*)

GLENN FRANK,
President, University of Wisconsin.

THE DEVELOPMENT OF FOREST RESEARCH IN CALIFORNIA[1]

By C. L. HILL

Senior Forester, California Forest Experiment Station

The development of forest research is an important chapter of American forestry history. Its record will doubtless be accumulated in the stories of regional development. The writer makes a contribution to this record for a region where forest research has abundantly proved its mettle. The problems research has met in California are largely those of the country as a whole, thus giving this article more than state-wide significance.

WITHIN the limits assigned for this paper it is manifestly impossible to give much detail in respect to research projects or results. It is also difficult to paint any picture of California research entirely apart from the rest of the country, especially in respect to the initial background.

I suspect that foresters trained within the last fifteen years can hardly realize the dearth of authentic information about American forests and forestry which was available to forest students in the days before the assumption by the U. S. Forest Service, in 1905, of its administrative responsibilities to the forest reserves then newly christened national forests. There was, to be sure, the "forestry bible", as the men of that time called the big compilation by Dr. B. E. Fernow of results gathered by the old U. S. Division of Forestry and its successor, the Bureau of Forestry; together with sundry bulletins issued after that compilation. There were the two early privately printed booklets, "*The White Pine*", published in 1896, by Pinchot and Graves, then young men fresh with enthusiasm from the study of forerstry in Europe, with its companion volume, "*The Adirondack Spruce*", and also the more ambitious "*Economics of Forestry*" by Fernow. On the dendrological side, coming from the longer established science of botany, there were three works of the first rank, Mischaux and Nutall's "*North American Silva*" in five volumes; "*The Silva of the United States*" by Sargent, in fourteen volumes; and the Volume X of the census of 1880 on the forests of North America, also compiled under Sargent's care. Other than these, the available forest literature was mostly popular propaganda of little value for the technical student.

Since the first establishment of the Division of Forestry in 1886, there had been the anomalous situation of a governmental forestry organization with no forests to manage, while the forests which the government owned were administered under another department which had no technical personnel adequate for this responsibility. Practically the only province which this slenderly financed Division of Forestry had consisted of the two fields of forest investigation, and of extension advice to the public about the management of private forest lands which that public did

[1]Presented at the second annual meeting of the California Section, Society of American Foresters, at San Francisco, Calif., Dec. 17, 1929.

not know were in need of any "management". But the distinction between the two functions, investigation and extension, was not very clear, except in respect to forest products, in which at an early date under Dr. Fernow, Filbert Roth and H. D. Tiemann, really technical and scientific work had been commenced in wood technology and timber testing. Especially in the embryonic silviculture-forest management domain was the confusion or intermingling of the two functions conspicuous. The investigational work upon which working plans should rest had not been done and had, perforce, to be done as a part of the project, in these early working plans which constituted a large proportion of the bulletin literature and which all the older men will remember, such as that for Nehasane Park in the Adirondacks, and that for forest lands at Sewanee, Tennessee.

As a matter of fact, little, if any, of the early investigative work was really research. It was observation of objective facts, or the search for facts by simple experiment; that is, it was investigation in the specific sense which has recently been emphasized by Weidman,[2] rather than the experiment under controlled conditions and rigid verification, which is research.

The "*Field Program*", predecessor of our present "*Service Directory*", was in the early years all that its name signified, giving the projects upon which men were engaged, along with their names and official stations. These programs are exceedingly enlightening in respect to the kind of work then being prosecuted, and I shall risk reproducing the project list for California, from one of them at random. In January, 1906, after a few months for the organization to get under way, with Pinchot as Forester and O. W. Price as Associate, the dendrologist was George B. Sudworth, now deceased; forest management, which included silvical investigative work, was in charge of T. H. Sherrard; products, the only remaining unit having research activities, was in charge of Wm. L. Hall, with R. S. Kellogg as assistant chief.

The project list in the Field Program for that month shows the following, including some entries not primarily investigative, for the interest of their personnel. [Note that all projects for each state were listed together, the organization unit responsible for each project being designated by a marginal letter in parentheses, for which the legend was, Dendrology (D); Forest Management (M); Forest Extension (E); Forest Products (P); Forest Reserves (R).]

(D) New and little known eucalypts for the United States—Prof. A. J. McClatchie, Los Angeles, California.

(D) Study of tanbark oaks of the Pacific Coast—Prof. W. L. Jepson, Berkeley, California.

(D) Special studies of little known California trees; four-leaf pine, Torrey pine, Bishop pine—Prof. W. K. Dudley, Leland Stanford University, California.

(D) Study of native and exotic acacias —Prof. A. V. Steubenrauch, Berkeley, California.

(M) Inspection of timber cutting on forest reserves—W. B. Greeley, Oakland, California.

(M) Study of the white fir—P. D.

[2]Weidman, R. H. What is research? Northwest Science, 3:2; 42-44. June, 1929.

Kelleter, San Francisco, California.

(M) Working plans for portions of the Sierra Forest Reserve—M. B. Pratt, Glennville, California; assistants, C. J. Buck and J. Rebmann.

(M) Examination of proposed cuttings, Santa Barbara Forest Reserve—P. T. Harris, Stauffer, California; assistants, W. B. Piper, W. G. Durbin, H. L. Tucker, I. F. Eldredge.

(M) Examination of timber in the Santa Barbara Forest Reserve—F. G. Plummer, Care W. B. Greeley, Oakland, California.

(E) Study of State Forest lands in coöperation with the State—S. J. Flintham, Sacramento, California.

(E) Preparation of planting plans, in coöperation with land owners—G. B. Lull, Los Angeles, California; assistant, H. O. Stabler.

(E) Nursery and planting work, Santa Barbara Forest Reserve—G. W. Peavy, Pasadena, California; assistant, B. R. H. D'Allemand.

(E) Nursery and planting work on the San Gabriel forest reserve—G. W. Peavy; assistant, A. T. Searle.

(P) Tests of the strength of eucalyptus wood, in coöperation with University of California—L. E. Hunt, Berkeley, California; assistant, A. J. Cleary.

(P) Experiments in preservative treatment of fence posts—R. W. Ayres, Los Angeles, California; assistant, A. H. Pierson.

(P) Experiments in seasoning and treating telephone and other poles for electric wires, in coöperation with electric companies in southern California—W. R. Wheaton, Los Angeles, California.

(R) Examination of lands for new forest reserves—W. H. B. Kent, Los Angeles, California.

It should be remembered that this list is only that for the one state, out of twenty-four in which at that time work was being carried out, (although, to be sure, California was one of the heaviest in this list). Today, the list reads like a roster of the since great and near-great, but it should be remembered that these men, and all the rest of the Forest Service personnel of that day, were mere youngsters, out of college a very few years at most—like our present assistant and even junior technicians. I have not been able to find that there was then (since the resignation of Dr. Fernow) a Ph. D. in the organization, and practically none of the men had had any specific training for research. In such inexperienced hands were even the high destinies of the Service and the profession. Of course this but emphasizes the daring of Mr. Pinchot, in undertaking such a job with his "crew of boys".

There are many diverting lights thrown by this list upon the current research situation. Time forbids allusion to more than the absence, then as practically ever since, of any grazing investigative projects in California, and the extent, as shown by the first four items, to which the young organization was leaning for its small amount of formal research upon college professors of botany, drafted for the purpose by the collaborator method. One cannot help, also, an indulgent smile at the brave hopefulness of Kelleter's assignment to the "Study of White Fir", which after 24 years is still a vexatious rat hole down which more investigative time and money must be poured.

The establishment in December, 1908,

of the Forest Service administrative districts, and the "great hegira" which accompanied it, caused a large personnel redistribution throughout the Service. In the field program for the following July, under the Branch of Silviculture, then presided over by W. T. Cox, with E. E. Carter as assistant chief, appears the noteworthy entry, "Office of Forest Management, E. H. Clapp, Chief (in the field), W. B. Greeley, Chief." The office of silvics was under Rapahael Zon, who was soon joined by S. T. Dana as assistant chief. In California F. E. Olmsted was district forester, with Coert DuBois, associate. Silviculture was presided over by G. M. Homans with T. D. Woodbury as assistant. In this silviculture office planting work was under G. W. Peavy, and silvical investigations under F. R. Cooper.

Doubtless the development of research work, which soon began to take productive form, was given direction by the men who in 1908 began to guide the destinies of this Forest Service district. In the Field Program of July, 1909, which has been quoted, appear two entries which show the leaven already then working:

"Collection of data for volume and growth tables for the leading commercial species in the Sierras—S. W. Allen, Gerald Kennedy and Frederick Thomas, Sonora, Calif.

"Establishment of sample plots and organization of silvical work—S. T. Dana, San Francisco, California".

The first is significant in respect to a new content of research work; the second in respect to a new direction and control. Both soon were to become manifest.

The significant change, however, did not come until about 1910-11. During the period from 1905 to about that date, indeed, there were developing malign influences which bade fair to strangle the infant American forest research in its cradle.

The first of these dangers to forest research arose in the house of its friends, through failure to realize the extent to which research is an exacting and jealous goddess, suffering no others before her. If research was good, then the more forest officers who cultivated it the better; not only were the district office men to be researchers, but all the technical field men. New field men who felt the urge set out upon investigative studies to the limit of toleration of their supervisors, without guidance and even without the knowledge of the district office, until a voluminous report came in. The annual reports from the forests called for a section on silvical observations, and if the technical assistant failed to write such a report it was cause for suspicion of the genuineness of his conversion to the faith. Unavoidably, under such circumstances, many of the annual silvical reports degenerated into meaningless wordiness.

The second danger was the Philistine revolt against high-brow European refinements, including research, which followed upon the sudden assumption by the Forest Service of administrative responsibility for the national forests, with its tremendous burden of practical jobs in getting acquainted with the physical property and organizing the machinery of control. The sag in the quality of research work played directly into the hands of those in this state of mind.

In California a third danger was the obsession that forest planting was the only medicine which could save south-

ern California from an untimely death, and must be administered to the patient in unlimited doses. This furor was due chiefly to T. P. Lukens, a man whose enthusiasm, fortified by only the slenderest knowledge, was able to draw a large and influential following. And G. B. Lull, an early Forest Service man, later State Forester, was Allah's prophet. Planting and planting investigations were the order of the day. The Forest Service never approved the debauch of eucalyptus promotion which developed out of this planting craze; in fact, it strenuously opposed it and spent much time and money in building up the facts to buttress its opposition. But planting and planting experiments took a disproportionate amount of Forest Service time and effort for a number of years. Like most of the investigative work of the period while the workers were finding their feet, this work was to an unfortunate extent unorganized and inadequately controlled, and resulted mostly in failure. It had, however, a real negative value in demonstrating what could not be done and in putting planting into its proper secondary position in California forestry practice.

American forest research in its first period, then, must be characterized as largely haphazard and unorganized, without either a clear conception of its major objectives, or manpower trained in technique. It was largely, therefore, ineffective. Much knowledge, however, was accumulated which had to be accumulated before anything more intensive could be done. Perhaps the chief value of the research of this period was in training personnel, in weeding out men unfitted for research, of whom too many had been obliged to dabble in it, and in permitting the research workers who survived to find their feet and become ready for really fruitful accomplishment.

The writer realizes that the preceding discussion has enlarged upon the first period beyond the bounds of proportionate balance in a restricted paper; but it has been done intentionally, both because of the intrinsic interest of the early workers and their struggles, and because of the extent to which the character of its beginnings has conditioned the whole subsequent course of forest research among us.

The beginning of the second period I have placed at about 1910-11, largely because of the influence of personalities. The succession of Dean Graves, as Chief Forester, in 1910, was followed in California in 1911 by the resignation of Olmsted and the promotion of DuBois to the district forestership. Also, it was about this time that Homans, the former district chief of silviculture, dropped out of the picture and his assistant, Woodbury, stepped into his own as Assistant District Forester.

In June, 1910, also, Dr. E. P. Meinecke was assigned to the San Francisco district office as consulting pathologist, and in the July field program of that year appears the first of his fruitful projects, "*Study of Tree Diseases in California National Forests*". This led to the little manual of "*Forest Tree Diseases Common in California and Nevada*", published in 1914. Meinecke had from the first the clear vision of forest pathology as something radically broader than the mycology which was the extent of its content as given in the forest

schools at the time. The perspective point was to be, not the fungus in itself, but the tree attacked by the fungus and the effect of such attack upon the forest complex. This led, first, to his contribution to the development of forest sanitation in connection with timber sales, and flowered in the concept of pathological rotation, as stated in his bulletin "*Forest Pathology in Forest Regulation*", published in 1916. He saw forest pathology thus as an integral element of forest regulation and management and saw, farther, what was and still is too largely unrealized even among foresters, that the regulated forest of the future must be something fundamentally different from just a reproduction of another such forest as those which this generation has cut down. It is not too much to say that he was one of the major forces in bringing about the second period of research, that of organized and effective research.

Doubtless as a result of the changes which have been related, there appeared in 1911 the expansion in scope of research evidenced by the program entry, "*Study of insect infested timber*—J. M. Miller, Northfork"; also the first of the successive additions to silvics district personnel, J. A. Mitchell, who was followed by L. T. Larson, H. A. Greenamyre, and soon by E. N. Munns.

This movement culminated in 1912 in the establishment of the Feather River Experiment Station, under the charge of Greenamyre, followed in the same year by that of the Pilgrim Creek Nursery on the Shasta. The Feather River station devoted its attention to silvics, thinning studies, nursery and planting practice, and the methods of cutting studies which were to become so fruitful under Show and Dunning. Considerable work was done for a time in mensuration studies, leading to volume and yield tables, both by the district organization and by the technical assistants on some of the forests, conspicuously good work being done by Gallaher of the Tahoe. Later, insufficient resources caused this line of work to be more and more neglected, from which it has not recovered in the research of this district to this time.

Converse Station, which was established in the following year in the South, with Munns in charge, soon came to devote its major attention to forest influences and the effect of fire upon erosion and flood control. The year 1913 also marks the heyday of the district Products organization, with five technical men on its staff. The products work at this period was not confined to any one line, including both wood utilization and wood preservation projects, but the unmistakable trend was in the direction of the latter, and for many years wood preservation projects constituted the bulk of the program.

In 1912, also, the work on forest insects in the district, under J. M. Miller, was extended by the assignment to the district office of Ralph Hopping, especially for the study of bark beetles, and by the establishment of Field Station No. 5 of the Bureau of Entomology under Dr. H. E. Burke at Placerville.

Two items remained to complete the picture of forest research as it was to continue largely to the present time. These were the systematic study of fire and the study of economics, the establishment of both of which is largely to

be credited to District Forester DuBois. DuBois has been accused of being unfriendly to research. A keen thinker, of unusual clarity, he did see the uselessness of pseudo-research, such as was recorded by the silvical reports of the time, and he promptly did away with that futility. He also, not so wisely, believed that products research was only a service to the lumberman, and had no place in a district organization whose main business was the running of public forests. He failed to see the possibility of such a service by forest products research to forest management policy as has recently been realized in the Rocky Mountain district, where a serious upset in the whole management scheme for the Engelmann spruce forests was obviated by the Forest Products Laboratory finding modifications of treating methods which would give acceptable penetration on that species, and thus prevent its being refused for tie purposes by the railroads. He felt, therefore, that if the lumbermen wanted products research they should establish and finance it themselves. If the Forest Service must indulge in such subsidy to the industry, then at least let it be confined to the Forest Products Laboratory. Thus the district products organization, from its spread in 1913, declined until, with the resignation of C. Stowell Smith in 1917, it was reduced to a one-man job, and for a time during the war was suspended altogether—to be revived only by P. G. Redington, when he became District Forester.

DuBois was not against really fruitful research, but he insisted that it should be directed toward vital needs. The first of these he believed to be fire. And, contrary to the thought of most foresters of the time, he concluded that fire was not too "practical" a problem to permit of material contributions to its solution being made by research. To this he gave much thought, resulting in his bulletin "*Systematic Fire Protection in the California Forests*", published in 1914. This bulletin still remains the fundamental piece of thinking in this field in California.

His second contribution was to an attack on the economics of timber supply in California. If the national forests were to serve two masters, namely the interstate trade in lumber and the needs of local communities for timber supply, and if they must also provide for popular recreation and perhaps divide their area with grazing, for the people's meat supply, it was time, DuBois concluded, that we take stock as to where our future timber working circles should be located, in order to protect the local communities and to serve all needs to the maximum degree. This led to his formulation of what was then called the "Economic project", which aimed to solve those problems in terms of volume, distribution, and needs of the population of California fifty years hence.

The year 1915 is signalized by two events. First, locally, is the appearance on the roster of the Feather River Experiment Station of the name of S. B. Show, who gradually worked into a larger and larger share of responsibility and, beginning with 1918, assumed charge of the silvical investigations section of the district office. One highlight in respect to fire research, to which he soon turned a large amount of atten-

ion, in collaboration with E. I. Kotok, was the Davis Conference in the winter of 1918-19, where Show presented the results of their analysis of the individual fire reports. For years these had been made, under vigorous protest by the field men at the uselessness of accumulating such information, only to be buried in the files. Their analysis of these reports, specifically for the Shasta National Forest whose fire history had been most disastrous, showed with astonishing clearness just what was responsible for the disasters, in too small personnel, excessive elapsed time interval, etc. This report electrified its audience and accomplished, as no other one thing did, the desired consummation of selling research to the field men of the district, technical and non-technical alike, as something not remote in the clouds but having a direct relation to their everyday jobs.

The other significant event of the year 1915 for forest research was the establishment at Washington of the new Branch of Research, with E. H. Clapp as assistant forester in charge. This marks the beginning of that coherent national policy and program of forest research development with which Clapp's name will in the future be inseparably associated. In California, however, research was still to meet with sundry vicissitudes.

The exodus to the war took many of the district men, including District Forester DuBois, who was succeeded by Headley as acting district forester. Partly due to the dearth of men, and partly to other causes, research work was greatly curtailed. There came to power a philosophy that what the Forest Service needed was "he-men," of brawn rather than of brains, and for several years the district took on no new blood in technical men. This has led to an "unbalanced distribution of age classes" in personnel, from which the district has suffered to this day. In 1917 the Feather River Experiment Station was relinquished to Dr. Meinecke, who conducted it in the furtherance of pathological investigations, for some five years. The Converse Station was abandoned in 1918, and even the section of silvical investigations in the district office was discontinued and the October field program of that year carried the entry, "Forest Planting—S. B. Show". Thus the fruits of the forest research tree were not to ripen, for the most part, until after 1920.

Thus far the story has been confined to the Forest Service. In 1914, however, a new factor had been injected into California research by the establishment of the Division of Forestry at the University of California. The new school found the subject field already covered, or at least spattered over, by Forest Service activities. It might adopt any one of the following courses: (1) Duplication of Forest Service work by way of verification or check; (2) the application of similar studies to different species or in a different area; (3) the pursuit of fundamental studies of a laboratory character, into which the Forest Service had not gone to any large extent. At that time the decision was for alternative (2), and for several years there was in effect a sort of gentlemen's agreement between the school and the Forest Service under which the school centered most of its research effort in

the redwood region, where the Forest Service had done practically nothing because of the absence of national forests. The school cultivated practically all the lines of silvicultural research with marked success. The nursery and planting investigations of the school contributed largely to the undertaking of extensive reforestation by the lumber industry. The school also tested the suitability for that region of a large number of imported species, especially those of the North Pacific region and eastern United States hardwoods, which cleared the fog previously existing in regard to their usefulness in California. Near Arcata they conducted thinning experiments in mixed redwood second-growth stands logged nearly fifty years previously. In the redwood region, also, under Fritz, forest products investigations have been carried out tying closely with the logging and saw-mill problems of the industry.

In the direction of management studies Donald Bruce, in 1916, shortly after his connection with the school, began studies on the cost of logging, transporting and milling different-sized timber, as had first been done in the southern pine region by W. W. Ashe for the Forest Service, beginning in 1909. Bruce's studies, carried on at two localities in the pine region as well as in the redwood region, produced results of striking value.

While the Forest Service had not conducted in California much or any of the conspicuously successful grazing research work which has excited the admiration of Europe, as well as of the rest of the world, yet the results of the experimental research centered at the Great Basin Station in Utah, and at the Jornada and Santa Rita Range Reserves in the Southwest, had been thoroughly applied in California national forest grazing practice and their results carefully checked. The school therefore centered its attention upon the foothill and chaparral regions where problems were presented which had not thus far been satisfactorily answered by any other agency. The earlier grazing instruction and research of the school was started by Professor Charles H. Shattuck about 1918. The aggressive work in range research, however, awaited establishment of the chair of range management and forest ecology under Professor A. W. Sampson in 1923.

This leads us into what I here regard as the third period of California forest research, whose beginning may be put at about the year 1920. The distinguishing marks of this period may be stated as, first, the trend toward an increasing proportion of work of a fundamental nature, that is, work in which the results of field observation and experiment are verified by methods under laboratory control; second, an increasing integration, or drawing together, of diverse lines of research. Both of these trends are, perhaps, inevitable, as research ripens, and both problems and technique dig deeper. At any rate, the new concept came to flower among the more advanced forest research workers very widely at about the same time.

During this period the laboratory method has been applied with conspicuous success, as under C. G. Bates at the Rocky Mountain Forest Experiment Station, to the study of efficiency of light utilization by different tree species; and

in later years, to the factors affecting the spread of fire and the combustibility of fire fuels. The Forest Products Laboratory, by the application of highly technical physical and chemical methods, is entirely remaking the subject of wood technology, to such an extent that the material which will be taught to future forestry students under that name will hardly be capable of recognition by men trained in the past.

Mensuration, too, under the leadership of Bruce, first at the California forest school and later with the Forest Service, has undergone a development, both in field and office technique and in the mathematical statistical control of its analyses, such that it may equally be said to have become a newly remade discipline.

But let us return to the forest research story at the University of California. In the development just described the Division of Forestry has played a most creditable part. The previous scheme of territorial division between the school and the Forest Service had not, in fact, been entirely satisfactory to either party and, as the fundamental research idea began to germinate, the school was one of the first to grasp its significance. It definitely decided to center its future efforts upon the more fundamental work.

In mensuration work, apparently, was started the new trend of the forest school research. This was developed, as already hinted, under the able direction of Bruce. Mensuration work, to be sure, must be done in the field, upon trees as they grow. The safeguard as to method is not laboratory control but statistical and mathematical control. For some time it had been clear to the better foresters that the traditional methods of volume measurement and analysis were not only unnecessarily crude, but were open to suspicion in respect to their mathematical and statistical validity. In 1920 appeared the first of a series of papers by Bruce, applying to mensuration the rigid control of statistical mathematics which, in the last ten years, has gone on to a radical revolution in the technique of the subject. But if Bruce is now gone from California, Schumacher has been ably carrying on the work thus begun, and his criticisms of the technique of volume and yield table construction are contributing as much in that field as are the actual volume tables which he has constructed for such California species as white fir, red fir, and second growth redwood.

In silviculture, too, the Division of Forestry of the University has carried out under Professor Baker a program adhering to fundamental study. Examples only can be given, such as his study of the isolated factors of environment upon the tree seedling, the first being the effect of high temperatures. Finally the grazing research of the school, to which reference has been made, has also utilized laboratory methods extensively; of which excellent examples are Dr. Sampson's studies of the carbohydrate nutrition of forage grasses, and of comparative forage and root growth as influenced by frequency of cropping.

The volume of work now being carried on in forest research is so great and so varied that it is impossible in this paper to discuss detailed results. No account of California research work, however, would be complete without

mention of the analysis which Duncan Dunning has made of the data from the methods-of-cutting plots scattered over the Sierras. This analysis has profoundly affected timber sale marking practice in the California national forests, increasing the cut per cent and decreasing the reserve timber volume; and the new tree classification which he has developed is providing the silviculturist with a new guide for his deductions of greatly increased reliability. Not less notable has been the continued work of Show and Kotok on the statistical analysis of fires, and their assembly of ammunition to fight the "light burning" insanity. These by their significance have done much to counterbalance the woeful inadequacy in the amount of fire research in this district, when measured in terms of its relative importance.

Of climax importance, on the silvicultural and management sides, has been the notable work of Show resulting in the publication of "*Timber Growing and Logging Practice in the California Pine Region*", in 1926. But the compilation of so comprehensive a symposium of the forest requirements of the region would have been humanly impossible without the cumulative results of real and vital research by many men throughout the preceding fifteen years.

Products research and extension work has continued through this third period of California research, since its re-establishment by Redington in 1920. In the main, its trend has been away from the predominance of wood preservation problems characteristic of its preceding period—important as those problems admittedly are from the standpoint of conservation of wood material—toward the problems of waste and losses in the timber conversion processes, as affecting both the manufacturer and the stumpage owner and the prospect of the practice of forestry in the woods. The marine piling project which monopolized so large a share of Hill's time for several years, may perhaps deserve status as a special case. Examples of the trend referred to are the air-seasoning study, the white fir study, and especially the recently undertaken coöperative woods and mill study.

In 1926, Show became district forester, and later in the same year the California Forest Experiment Station was established with Kotok as director. The Experiment Station appropriation permitted a considerable expansion over the work which had been carried on previously. Additions to the staff were, first Wieslander, who went into the big task of making a vegetative type map of the entire state, soon followed by H. W. Siggins, so recently cut off by untimely death. At the end of the year following, products research was transferred from the district office to the experiment station. Soon after this, came C. J. Kraebel, returning after a number of years in Hawaii and in the National Park Service, to take up the station work in southern California, particularly the ecological aspects which there tie together most diverse lines of study. Finally, W. C. Lowdermilk likewise returned, from years of development in China of special methods of experiment in water cycle and erosion study. In coöperation between the station and the University Division of Forestry, he has applied with striking results his con-

cept of the need for studying isolated factors by both field and laboratory methods, before embarking upon their interaction in so intricate a complex as a watershed.

The second major change discernible in this last decade, namely the movement of integration or of coming together of different lines of research, is a change in point of view which is affecting all research, as well as, indeed, administration. No line of research now stands by itself. Products and silvicultural research now attack different phases of the same problem; and at the Forest Products Laboratory a new section of Silvicultural Relations is trying to provide the unified laboratory technique to serve common problems.

The expression of this movement thus far has eventuated in a new conception of the objective of forestry and forest research, as a science and art of land management. Silviculture is, then, no longer a matter of special crops but an integral factor in this management of the total land resource. Products no longer serves the profit of the timber converter only, or even solely the conservation of wood materials, but unites with silviculture to forward a better stewardship of that management of land.

With this enlarged perspective is coming a new and increased coöperation. This is typified by the assignment, by other federal bureaus, of resident coöperators and consultants at the Experiment Station; first, H. L. Person from the Bureau of Entomology, then E. E. Horn from the Biological Survey. One of the most significant expressions of this trend is the woods and mill study just referred to, which under the general coördination of the products office has recently been carried out in coöperation between the Experiment Station, the University Division of Forestry, the District Office of the Forest Service at San Francisco with assistance from those at Portland and Missoula, and the offices of the consulting pathologists and entomologists, sundry forest supervisors, and a large lumber company. This study follows the timber clear from the marked timber stand, through all phases of logging and milling, with their costs and the wastes and damages involved, to the lumber on the shipping deck of the mill; its objective is to provide the information needed by timber owner and operator alike, on the costs and effectiveness of lumber conversion under different methods of timber marking, so as to provide a basis for determining the practicability of technical forestry methods.

All interests in California are coöperating in forwarding forest research. State and county support now doubles the effective accomplishment of the Experiment Station over what could be done on lagging federal appropriations alone. The general public concern in forestry, recognized in the Clarke-McNary Act, now registers in research, as a necessary prerequisite to forest practice, through the recent McSweeney-McNary Act providing for an extended and rounded program of forest research for the national government. The battle seems now to be chiefly one of making effective the increased support for research authorized in the McSweeney Act. Grazing research, investigative work in the redwood region, expansion of the work in forest influences and in

fire and mensuration, all urgently demanded in the state, wait upon this consummation. An experimental fire forest, where the best that is now known may be practiced and the known best may be continuously expanded by research; and an experimental forest where new ideas, from tree growing to tree harvesting, may be developed and proved, are also among the things which thus wait. Recently the work of the Forest Study Committee, under Professor Mulford, looking toward the formulation of an adequate forest policy for the state, and of the California Economic Research Council looking toward the comprehensive integration of studies of land utilization, are stimulating research activity, and correlation of our economic research with that in other fields; and more and more are focusing attention upon the newer concept of land management.

Research clearly is increasingly necessary, as problems ramify. Research problems increase faster than research resources. Demands upon the preparation and equipment of researchers increase faster than the supply of competent men, and those now in the game must run, lest they be left behind. But after all, these are, let us hope, healthy conditions. With the will to do, resources can mayhap be found; with stagnation of spirit they are of no avail. May we hope that in this, our majority year, our research may have escaped from the stigma of being RE-search—the product of enthusiasm backed only by professional or lay ignorance—and be emancipated into honest-to-goodness re-SEARCH!

THE CALIFORNIA STATE FOREST SERVICE ITS GROWTH AND ITS OBJECTIVES[1]

By M. B. PRATT

hief, Division of Forestry, Department of Natural Resources, Sacramento, Calif.

The author goes over the history of California's state forestry department and refers to some of its problems. He reports in ten years a manifold increase in public interest in forestry and in state support of forestry activities.

THE FIRST PUBLIC sentiment in favor of forestry in California found expression in an Act passed larch 3, 1885 creating a State Board f Forestry. At first this Board acted n the capacity of a commission of nquiry with emphasized educational nctions. Its field of action was limited nce the appropriation was only $5,000 or the biennium, out of which was paid ne salary of the Secretary at $125 per onth, the necessary traveling expenses f the members of the board and the mployment of assistants. The mem-ers of the Board of Forestry were bbott Kinney, James V. Coleman and . Kellogg.

In the first report to Governor Stone-an there was a description of the for-sts of Amador, Calaveras, Tuolumne nd Mariposa by Luther Wagoner, . E., and one by Abbott Kinney of ne forests of Los Angeles, San Ber-ardino and San Diego Counties. There as also a very interesting report on ne redwood region by Herbert Vischer, ngineer of the Board; also a report n tree culture experiments made by ne Southern Pacific Railroad Company, hich company had planted 45,000 eucalyptus trees along its rights-of-way in Alameda County for ties. These trees were afterwards cut and used for engine wood. Mention is made of a movement in San Francisco headed by Joaquin Miller, Adolph Sutro and General O. O. Howard for the setting aside of the last Saturday of January as Arbor Day for California.

On March 7, 1887, an Act was passed by the Legislature conferring police powers on the members of the Board and its assistant, for the purpose of making arrests for the violation of any law applying to forest and brush lands within the state, with an appropriation of $30,000 for the following two years. In the Board's second biennial report to Governor Waterman it was stated that the first efforts of the Board of Forestry were being directed towards a reform in the cutting of the public forests on the mountain watersheds, since individuals, companies and corporations were cutting timber pretty much as they liked, and without obtaining title, as the law requires to the lands cut over. Attention was drawn to the fact that the timber entries in the last sixteen months to May 1, 1888 were about one-third in

[1]Presented at the third annual meeting of the California section of the Society of American oresters at San Francisco, California, December 19, 1930.

amount of all the timber entries heretofore made in the state, and that so much of the timbered school lands had been taken up, that there remained no timber lands of value belonging to the schools in the state. The conclusion was drawn that the management of the forests by the lumbermen had greatly improved since their increased ownership of timber lands, and that they were in many cases looking to a permanent forest crop from lands formerly considered good but for one cutting.

The second biennial report is especially interesting because of the report by the distinguished botanist Dr. J. G. Lemmon and his wife on the native trees of California.

The second Board of Forestry, which consisted of Abbott Kinney, John D. Spreckels and Walter S. Moore, gave expression to the following statement: "Every day's delay makes proper forestry measures more expensive and more difficult. The condition of the nation in regard to forestry may be compared to the story of the Roman Republic and the Sibylline books. Each time these books of prophecy were offered to the Romans and refused, a certain number were destroyed. When they were at length purchased their price was enormous and the books were but a fractional part of what they had been. Thus it will be with forestry and forestry must come some day".

The third biennial report, 1889-1890, stressed the prevalence of forest fires and advocated action by the federal government on public lands. The statement was made that upon the Sierra Nevada side of the state the lumber resources seemed to be boundless, but that in the redwood region the forests will exist but (only) in theory in less tha 40 years, if the ratio of increase in ou export trade is maintained. Announce ment is made of the establishment o two experimental forestation stations,— one at Chico and the other at Santa Monica for the introduction and raising of tree stock—

"to make plantations that shall no alone yield the fruits of industry and skill, but concurrently add their quota to assist in maintaining the climatic equilibrium so essential to retain in order that California may continue to enjoy the supreme distinction as the possessor of the most perfect climate in the world".

The fourth biennial report, 1891-1892 to Governor Markham, announces progress with Congress in preserving the forests, in that the President, through the Secretary of the Interior, had withdrawn from entry and sale, large tracts of timber land in the Sierra Nevada Mountains and established several reservations and national parks, which were being patrolled and guarded by troops of cavalry. Attention was called to the great damage done by forest fires, and a bill was drawn up providing for the employment of fire wardens at a fixed sum per day for their services while actually employed in extinguishing fires, their bills to be passed upon and paid by the County Supervisors, all of whom were to be *ex officio* County Fire wardens; all wardens, however, to be under the control of the State Board of Forestry. This bill evidently never reached the Legislature since the Board of Forestry was abolished in 1893.

In commenting on the decline and fall of the Board of 1885-1892, Mr

Charles H. Shinn in an article in the University of California "Chronicle", April, 1923, says:

"The State Forestry Commission of 1885-92 came to an end because (as a careful analysis of its own reports will show any reader) it had slowly but surely drifted away from its own first start and larger aims. It became more of a Southern California institution, and with its small tree growing plantations at Santa Monica and Chico, from which many thousands of young acacias and eucalyptus were annually distributed, did but little towards creating, organizing, and directing public sentiment toward real forest conservation and scientific forest use. The movement which six years earlier had definitely undertaken a forest survey of the entire state, a campaign to prevent forest waste and the establishment of state forests, had now settled down to the care of a small arboretum on Chico Creek and another one in the Santa Monica Canon. It ceased to have any public influence, the appropriations ceased and the two small stations were taken over by the University of California and added to the system of farm stations, making six in all".

From 1893 to 1903, state forestry in California was at a standstill, yet this period was one of marked need and of rapid development along other lines. It was the decade during which the lumbermen from the Lake states and the Southern pineries flocked to California to invest in timber lands, and during which time California disposed of the bulk of her state forest possessions by the sale of school lands at the ridiculously low price of $1.25 per acre. Similarly, it was the period during which land fraud flourished, whereby much of the public timber land in California was lost to the national government and the state.

In 1903 sentiment in favor of forest preservation was expressed in a practical form when the Legislature provided for a thorough investigation of the forest resources of the state, by the then U. S. Bureau of Forestry, the expense of which was to be borne equally by the state and federal governments. Actual work was begun by the U. S. Bureau of Forestry on July 1, 1903 and carried on for four years. An examination of 21,000,000 acres of forest and brush land was made and a forest map of the state prepared, showing the extent and location of the commercial forest, woodlands and brush lands. A number of commercial tree studies were made. One of these was a study of white fir, and was the first assignment given the writer upon his arrival in California on July 1, 1905. He also gathered data the following winter on logging and milling costs in the Sierra Nevada region under the supervision of Colonel W. B. Greeley. An estimate and appraisal was made of the Calaveras Grove of big trees. There was also an investigation of the amount and character of the state's delinquent tax lands, which resulted in the recommendation that a system of exchange be worked out between the national and state governments, whereby the state could consolidate its holdings, and, if desirable, establish state forests. The results of this coöperative work done between the state and the U. S. Bureau of Forestry have been embodied in some seventeen comprehensive reports and maps and in about forty-five special

papers most of which have been published.

Due to the investigations made during the first two years under the terms of an agreement between the government and the state, a state forest policy was drawn up in the form of a bill and submitted to the Legislature in the winter of 1905 and adopted on March 18, 1905, after strenuous opposition which was overcome through the personal efforts of Governor George C. Pardee. Destructive amendments eliminated many of the protective features, such as an appropriation for the employment of state rangers and for the suppression of forest fires, but the bill was constructive in that it created a State Board of Forestry and the office of State Forester. The Board was *ex-officio* in character consisting of the Governor, Secretary of State, Attorney General and the State Forester.

The first State Forester was E. T. Allen, who was appointed on July 12, 1905. His appointment coincided very closely with the establishment of the U. S. Forest Service, which came into exsitence on February 1, 1905.

The first effort of the State Forester was to awaken the public to the damage being done by forest fires. Education rather than law enforcement, was emphasized, and coöperation was sought from the Water and Forest Association and other organizations. Efforts were made to enlist county coöperation. Santa Cruz County was the first to respond and four more counties offered their support by June 30, 1906, when the resignation of the first State Forester occurred.

Mr. Allen's successor was G. B. Lull, who devoted much energy towards county coöperation. According to the plan followed, the County Supervisors appropriated from the General Fund, a sum sufficient to pay citizens 25 cents or 30 cents an hour for actual services on fires. The amounts appropriated varied from $500 to $1000 depending on the size of the county and its financial condition. The Supervisors then recommended such citizens for appointments as fire wardens as they desired and upon this recommendation these men were appointed by the State Forester. It was found, however, that the State Forester had little or no control over this system, and he concluded that although ten counties had appropriated sums for the payment of wardens, poor organization had followed and results were very unsatisfactory.

In his 1908 report, Lull claims considerable progress in that he had appointed 721 Voluntary Firewardens, of which 269 were employed by the U. S. Forest Service. Evidently the fire suppression results were not satisfactory on the part of the State Wardens, since Lull advocates the payment by the state of one-half of their expenses and the county the other half. This would have entailed a state expenditure of about $15,000 a year which appeared to be a considerable sum, since the total appropriation for the biennium was only $22,100.

It was during Lull's administration that the planting of eucalyptus for future hardwood timber supplies was at its height. In this connection Lull says: "It may mean eventually that the eucalyptus industry will be even a more fruitful source of revenue to the State

of California than the orange industry has been."

It is interesting to note that in his report the State Forester devotes considerable attention to the California Redwood Park in Santa Cruz County which was then under his supervision. About twenty-eight miles of fire lines, from 30 to 60 feet wide were constructed, encircling the park. Apology is made for the reduction in the number of visitors throughout the previous year, due to an earthquake which destroyed the tunnels on the narrow gauge railroad from San Francisco to Santa Cruz, causing the road to be blocked all summer.

Lull resigned in 1909 and Governor Johnson appointed G. M. Homans as his successor in 1910. Homans starts out his biennial report for that year with an argument to show why the biennial appropriation for his office should be increased from $40,300 to $126,600. He follows with a general description of forest conditions in the State and the necessity for a forest fire organization financed largely with state funds.

Although he was not able to finance any state rangers, yet Homans managed to secure enough funds to employ two technically trained men to make cut-over land and mill studies.

In his 1912 report Homans again launches a campaign to secure more funds, especially for forest protection purposes. He says:

"State patrols should be supplemented by private associations of timber owners and by the several counties through their respective Boards of Supervisors."

He advocated dividing the state into thirty districts, with a paid patrolman in charge of each, their salary to be $75.00 a month and expenses, which he said would amount to about $100.00 per month for each man. His total requested increase for the biennium was $154,600 which included rangers' salaries and expenses, suppression funds and the purchase of 160 acres of cut-over land on which practical methods of reforestation could be worked out.

During the 1913 session of the Legislature two forestry bills were introduced providing funds for a fire organization, but neither bill became a law, due to the conflict which ensued between the proponents of the two measures. In the general budget, $50,000 was granted for forest protection, but the defeat of the bill providing for its expenditure rendered this amount unavailable. About this time two publications were issued from the State Forester's office. One was "*Wood Using Industries of California*" and the other "*Pharmacal Plants and their Culture.*"

The 1914 report was devoted chiefly to arguments for larger appropriations and the need for revised forestry legislation, but nothing was done by the 1915 Legislature, except to increase the biennial appropriation $2,000 over that of the preceding biennium, making a total of $45,800.

There was little activity along state forestry lines until 1919, the chief features being the passage of an Act by the 1917 Legislature establishing a State Nursery. Homans still continued to hammer away on the need of a fire-fighting organization, and in 1919 secured an appropriation of $25,000 for the biennium for this purpose, and

authority to enter into agreements with representatives of the U. S. Government or with counties, municipalities or individuals.

An Act was also passed giving more authority to the State Forester in the enforcement of the state fire laws, and setting up a State Board of Forestry consisting of five persons, one from the timber industry, one from the livestock industry, one from the grain and hay industry, one at large, and the State Forester. This board superseded the *ex officio* board which had been in force up to this time and which rarely held a meeting.

The appointment of Dr. George C. Pardee as Chairman of the new Board of Forestry led to a period of expansion in state forestry work which has continued almost uninterruptedly until the present time. One of the first activities was a joint meeting between the Board and the lumbermen of the State, at which the Capper Bill was discussed. At this meeting the matter of slash disposal was considered, resulting in signed agreements with 260 operators to dispose of their slash in such a way as to save the young growth left after logging.

Stimulated by the appropriation of $25,000 for the prevention of suppression of forest fires, the Board authorized an agreement with the federal government, whereby $3500 became available under the Weeks' Law. Through the combined state and federal funds the State Forester was enabled to employ four rangers, one for Shasta County, one for Butte and Yuba Counties, one for Placer and Nevada Counties and one for Eldorado, Amador and Calaveras, their period of service being from July 26 to October 15, 1919. In 1920 ten State Rangers were employed, and the area protected was increased from 3,500,000 to 8,550,000 acres. There were also two rangers assigned to grain protection work in the Sacramento and San Joaquin Valleys, which work had been started during the War following an appeal from the Federal Food Administrator for California.

In 1921 the Legislature increased forestry appropriations to $75,000 for the biennium, and with the $22,750 secured under the Weeks Law and $17,000 from counties and private agencies, the State Forester in 1922 was enabled to employ 21 Rangers, 2 Inspectors, 2 men on slash disposal and 2 lookouts. The first state lookout erected was on Mt. Bielawski in Santa Cruz County, which was financed largely from funds contributed by Santa Cruz, Santa Clara and San Mateo Counties.

About this time the effect of cover on stream flow became a matter of paramount interest, and led to the adoption of Senate Concurrent Resolution No. 27 by the Legislature, directing the State Board of Forestry to make an examination of mountain areas that were being denuded of vegetation, and to report to the next Legislature a plan whereby they may be reforested or otherwise covered with protective vegetation. This investigation was made by E. N. Munns, Forest Examiner, who presented a very comprehensive report to the Legislature of 1923. This report stated among other things that:

"At least $75,000 a year should be spent by the State at the present time for fire prevention and suppression, and

a definite policy of graduated increases in funds for the gradual expansion of the work to a higher degree of efficiency should be adopted".

The state park movement experienced a sudden revival in 1921, due to the efforts of the Save-The-Redwoods League, which sponsored a bill carrying an appropriation of $300,000 for the purchase of redwoods for state park purposes. Inasmuch as the state parks were under the supervision of the State Board of Forestry at that time, Solon H. Williams, a member of the board, was delegated to negotiate for redwood lands lying along the redwood highway, and accomplished a piece of work which will stand as a monument to his memory for all time.

It was in 1921 that State Forester Homans died, the writer being appointed his successor by Governor Stephens in November, 1921, after having served as Deputy State Forester from February 1st, 1918. Unfortunately, he was confronted by a change of administration which at first was extremely unfriendly to forestry, but which gradually saw the light, until by the end of 1926, the State Forester had increased his force by ten men and had raised the number of coöperating counties from twelve to twenty-one.

During the Richardson administration, the Legislature passed an enabling Act, which permitted a constitutional amendment relating to the non-payment of taxes on growing timber up to forty years of age, to appear on the ballot. It was adopted by the people by an overwhelming majority and instilled new life in the hearts of the friends of forestry.

In 1927 Dr. Pardee was again appointed Chairman of the State Board of Forestry after a lapse of four years, and immediately stimulated the very competent board appointed by Governor Young to serve with him, to put forth valiant efforts along forestry lines. This board, led by the redoubtable Doctor, so besieged the Department of Finance and the Governor, that a greater percentage increase was given to the forestry budget, than to the budget of any other state agency. County appropriations picked up, a number of new counties sought state supervision in fire protection and the federal government recognized the state's efforts with gradual increases from Clarke-McNary Law funds.

Under the Young administration the cabinet system of government was set up, the Division of Forestry being embraced in the Department of Natural Resources, of which Fred G. Stevenot was appointed Director. Under the Act setting up this department, the State Forester ceased to become a member of the State Board of Forestry, and acts instead as its administrative officer. The number of the members of the Board was increased from five to seven, one of whom shall be familiar with the pine industry, one with the redwood industry, one with the livestock industry, one with general agriculture and one with the problems of water conservation. The state parks were placed under the administration of the State Division of Parks, thereby emphasizing the desirability for state forests.

As mentioned before, the cream of the timbered school lands was lost to the state years ago, but of the skimmed

milk enough timbered land was found for exchange with the Federal Government, to secure a tract of about 10,000 acres known as the La Tour area. This area, which was formerly a part of the Lassen National Forest, contains about 100,000,000 feet of timber, besides large areas of brush lands coming back to timber. It is not now a state forest, although belonging to the state, but efforts will be made at the coming Legislature to make it so.

At the present time there is only one state forest, located in Napa County and containing an area of 800 acres. It was a gift to the state from Mr. and Mrs. Anson F. Blake of Piedmont.

Many steps in the development of our present state forest policy have been omitted, due to the limitations of this paper. Time does not permit of a discussion of the Compulsory Patrol Law, the gradual inclusion of special forestry appropriations in the state budget, the development of fire fighting trucks, or the coöperative projects with the many agencies actively engaged in the promotion of forestry, such as the California Forest Experiment Station, the Extension Forester, the California Forestry Protective Association, the State Chamber of Commerce and the Southern California Conservation Association. Suffice it to say, many factors have contributed to the progress of state forestry work in California—the principal one being the loyalty and devotion of the state forest officers to their work.

To summarize: It was eleven years ago that the State of California started its fire protection organization with four rangers. This year it had one of the largest field forces of any state in the Union, numbering 178. In 1922, when the plan of county and federal coöperation with the state began, a total of $77,250 was available from all sources. This fiscal year, state, federal, county and private funds under the control of the state for forestry purposes, totals $612,715. The total area protected is about 40,000,000 acres of which about 19,000,000 acres is classified as timber and watershed area.

Never before has there been such a strong sentiment for forestry in California as there is today. Following a meeting held in Sacramento on February 4, 1930, forty-two agencies representing many thousands of people, approved the principle of a $100,000 progressive increase in the state forestry budget each year for forest fire prevention, until the estimated cost of adequate protection of $800,000 a year had been reached. Verily, the voice of the prophet Joel, whose lament it was that—

> "a flame hath burned up all the trees of field"
>
> and
>
> "The beasts of the field cry also unto Thee; for the rivers of waters are dried up, and the fire hath devoured the pastures of the wilderness"

has reached the ears of the people of California.

IS SILVICULTURE POSSIBLE IN AMERICA?

By WARD SHEPARD

Article IV—Realism in Organized Control[1]

In dealing with the destructive lumbering of private forests, the American forestry movement has lacked the boldness and realism with which it saved the public forests. With a final attack on the "let-alone" policy, the author asserts that the real obstacle to preventing destructive lumbering is not its inherent impossibility but failure to work out sound principles of control that can be implemented in practice. He therefore suggests a set of principles designed to overcome the constitutional, administrative, and human obstacles to public control, as the final step toward making silviculture possible.

IN CREATING the National Forest system, the American forestry movement was bold and realistic. Forty odd years ago, when the pioneers of forestry took a stand for keeping the public forests in public ownership, they were far ahead of the political and economic thought of their time. Except to a few far-sighted men, public administration of great areas of forest land was among those things that Kipling has classed as "the utterly absurd, the hopelessly impossible and vain." The National Forest system has been a triumph not only over immense physical obstacles, but even more over a state of mind.

In dealing with the problem of private forest destruction, on the other hand, the forestry movement has been far more conservative, has been at once less realistic and imaginative, has suffered from intellectual confusion and political conflict, and has come to a halt before an obstacle that is in no small measure a state of mind. Organized control of forest exploitation is, to many people, as difficult to conceive as public forest administration was to their conservative predecessors of a generation ago. There are, of course, important differences between the two problems, notably the question of property rights. Nevertheless, in both cases, the greatest stumbling block has been the same: namely, the difficulty of imagining the *concrete steps* by which a general principle (public ownership, public regulation) could be successfully "implemented" in practice. In neither case has the question of land ownership been the deciding factor. In both cases, the question of practicability has been dominant.

In the creation of the National Forests, the first important step was the acceptance of the basic principle *that a system of National Forests was not only necessary but practicable.* Only after this step was taken was it possible to deal realistically one by one with the means of implement this principle. To make this principle work required the creation of a set of administrative principles and an administrative system that by their nature and results would make impossible the incompetence, corrup-

[1]Articles I. Skepticism and Faith, II. Men and Trees, and III. Realism in Education, appeared in the Dec., 1930, Feb. and March, 1931, issues, respectively.

tion, and bureaucratic tyranny that supposedly inhered in any form of public administration of property. The brilliant success of National Forest administration has fully vindicated the judgment of the men who thought the goal was worthy at least of the risk of bold experiment.

In the case of private forests, the goal of creating a national plan to halt the tide of forest destruction likewise deserves the risk of bold experiment. As was true of the National Forest system, it is necessary to start by accepting the basic principle *that organized control is necessary and practicable,* to cease centering attention on the assumed (but untested) impossibilities and, instead, to explore, step by step, the mechanisms and procedures needed to convert destructive logging into silvicultural logging. Until a positive process of this kind is set into full motion, until we consciously and fully explore the possibilities and limitations of joint public and private action in stopping forest destruction, our treatment of the problem will remain unrealistic and largely sterile.

There are two stages in the development of a positive approach to the problem of private forest exploitation. The first is to get rid, once for all, of the "let-alone" or *laissez-faire* attitude which vitiates reasonable progress on the private forest problem by assuming that substantially nothing can be done to control forest exploitation save by the individual and free choice of the land owners. The second step is to explore and define a set of basic principles by which the supposed absurdities and impossibilities of organized control can be met and overcome in a rational, progressive, and humanized way.

If we analyze a little further the effects of the *laissez-faire* attitude toward private forests, we shall find that it has had a profound and far-reaching effect on many of the major phases of forest policy. First, by assuming that the free choice of the individual owner was the only possible basis of advance, it has led to placing the chief emphasis on indirect methods of approach, such as tax reform, public research, improving markets, furnishing cheap planting stock, and other economic aids—all highly useful and important, but demonstrably inadequate as the main means of promoting better forest practice. Second, by minimizing the possibility and the need of direct methods of dealing with logging processes, it has retarded the growth of a realistic and substantial program of education and coöperation directed to these processes. Third, it has thwarted realistic consideration of methods of control adaptable to American conditions, and has substituted fruitless debates on academic political and economic theories, many of them long since obsolete. Fourth, by stressing the impossibility of direct control, it has led to overdependence on public forest acquisition as the principal remedy. And public acquisition has been itself deeply colored by the *laissez-faire* doctrine, in that it has emphasized all sorts of indirect reasons for public forests (ranging from watershed protection to the rehabilitation of low-grade forest land on the untenable theory that private initiative will voluntarily attend to the high-

grade land), and has under-emphasized the simple, obvious, direct, and overwhelming reason of preserving forests as such. And finally, the more extreme advocates of radical individualism, tacitly admitting the inadequacy of *laissez-faire* policy as a means of stopping forest destruction, have in recent years discounted the need of any stronger policy by urging that forests are no longer of prime importance as natural resources. Thus the *laissez-faire* idea, in its extreme form, is driven to the *reductio ad absurdum* that the rights of private property are such that without substantial interference mankind can be deprived of forests in part or *in toto* and of all their benefits, direct or indirect.

Overdependence on a gigantic program of public acquisition as the chief protection against forest devastation is not justified by the historical facts. For one thing, it is too slow. To obtain public funds for the purchase and development of scores of millions of acres of forest land would require many decades. Moreover, private initiative, with such public regulation as is needed, is the typically American way of doing things; and public control of forest exploitation can be justified to the American people at least as easily as the purchase of 50 or 100 million acres of forest. Public acquisition, therefore, is not a substitute for private forestry; it is merely coördinate and complementary to it. This is said not to diminish the great importance of a large program of public acquisition; but in order to assign to direct dealing with the private forest problem its rightful place as an immediate and practicable means of attack.

Let us now approach the private forest problem from the other end. Instead of beginning with what can't be done, let us begin with what *can* be done. Instead of an indirect approach, based on vague and often ineffectual incentives and fundamentally on a negative view, let us start with the simplest, most obvious, and most direct approach: "What *can* be done, here and now, to start a progressive system of improving the physical steps of forest exploitation; something that will work; something that will engage the attention of woods owners and workers, and gradually form new habits and new mental outlooks on the treatment of the forest"?

This shift in approach is based on the assumption that the basic problem of forestry is one of mental outlook and that any large advance demands an adequate method of changing this outlook. From the standpoint of public interest, the shift means that the further development of private forest conservation will be based, not on radical individualism and *laissez-faire* evolution, not on piecemeal opportunism, but on an integrated plan of direct control. Such a plan must recognize that it is not necessary to wait for an economic millenium in order to improve present forest exploitation. It must insist that the most must be done under present economic conditions instead of the least. Above all it must get down to the "brass tacks" of going into the woods, studying the logging methods, finding out possible reforms, getting the active interest of the management, and training the subordinate personnel in the elementary steps of silvicultural logging.

It has been alleged that a really large national effort to prevent forest destruction is not justified because we cannot now predict future timber needs and because therefore there is danger of growing more timber than we need. I pointed out in the first article[2] that for several generations the only probable overproduction through growth is in low-grade timber. Both those who advocate that every acre of forest land must be brought under intensive silviculture and those who fear overproduction from this cause, are dealing with a physical impossibility. Large areas of forest land have been rendered sterile; and with the most intensive forestry program realizable in actual practice during the twentieth century, much of this land will inevitably remain sterile.

A program of realism adjusted to facts, moreover, will naturally place the greatest effort on high-grade land, both private and public (just as the farm program is doing) and will put the least effort on low-grade and devastated land. In other words, rational control will demand *differential treatment* of different classes of land. On large areas of low-grade land there would be at most a minimum measure of fire control (largely at public expense) which would not ordinarily produce a grade of timber that would compete with the products of real silviculture. In fact, those owners who are practicing good silviculture will have and probably maintain for a long time a favored position as producers of a commodity with a "scarcity value."

If, then, we accept a program of "direct action" as a necessary and practicable goal, the next step is to determine the principles that will free such control from the greatest number of objections and give it the greatest degree of acceptance. It is not my purpose here to deal with detailed machinery for the control of forest exploitation. I have elsewhere[3] suggested possible types of organization adapted to that purpose. Our present task is to attempt to discover sound guiding principles on which the idea of control can be converted into successful action.

The Legal Basis of Public Control

Much time and breath have been spent on the supposed illegality of interfering with the private forest owner's right to do as he pleases with his own property. This is a naive and uncritical attitude toward property rights not supported either by common sense or by the law. The courts have specifically ruled otherwise. In a question involving the right of the State to control the exploitation of forest property, the Maine Supreme Court enumerated two reasons why the right of the public to control and limit the use of private property is peculiarly applicable to property in land:

"First, such property is not the result of productive labor, but is derived solely from the State itself, the original owner; second, the amount of land being incapable of increase, if the own-

[2] Journal of Forestry, Vol. 28, No. 8, Dec., 1930.

[3] "Coöperative Control: A Proposed Solution of the Forest Problem", Journal of Forestry, Vol. 28, No. 2, February, 1930.

ers of large tracts can waste them at will without State restriction, the State and its people may be helplessly impoverished and one great purpose of government defeated. . . . We do not think the proposed legislation would operate to 'take' private property within the inhibition of the Constitution. While it might restrict the owner of wild and unrestricted lands in his use of them, might delay his taking some of the products, might delay his anticipated profits and even thereby might cause him some loss of profit, it would nevertheless leave him his lands, their products and increase, untouched, and without diminution of title, estate or quantity. He would still have large measure of control and large opportunity to realize values. He might suffer delay but not deprivation. . . . The proposed legislation . . . would be within the legislative power and would not operate as a taking of private property for which compensation must be made".

The Supreme Court of the United States has likewise affirmed the right of the public to protect its natural resources, regardless of the will of the owner. In a decision of April 6, 1908, primarily involving the right of the State to control the use of rivers within its borders, Mr. Justice Holmes said:

"The State as quasi-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water, and the forests within its territory, irrespective of the assent or dissent of the private owners of the land most immediately concerned. . . . . It appears to us that few public interests are more obvious, indisputable and independent of particular theory than the interest of the public of a State to maintain the rivers that are wholly within it substantially undiminished, except by such drafts upon them as the guardian of the public welfare may permit for the purpose of turning them to a more perfect use. This public interest is omnipresent wherever there is a State, and grows more pressing as population grows.

"We are of the opinion, further, that the constitutional power of the State to insist that its natural advantages shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent of present use or speculation as to future needs. The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and there are benefits from a great river that might escape a lawyer's view. But the State is not required to submit even to an esthetic analysis. Any analysis may be inadequate. It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will".

Division of Federal and State Responsibility in Public Control

A second source of confusion in formulating a workable method of controlling forest exploitation has come from the opposition between federal and state power. It has usually been assumed that regulation must be all federal or all state. The conception of a nation-wide, highly centralized system of federal regulation has invoked strong opposition from many quarters, partly colored, no doubt, by experience of federal prohibition, which inevitably calls up the picture of the "two-gun" federal enforcer, often unpopular and unsupported by local opinion. Federal regulation has been painted as inflexible, arbitrary, bureaucratic, and unable to allow for local conditions and handicaps. State regulation, on the other hand, has been pictured as undepend-

able and, in fact, unattainable. It has been pointed out, with considerable truth, that in many states where public control is most needed, the lumber industry is politically so strong as to be able to prevent such control. In the opinion of many people, if state regulation should ever come, it would doubtless come so slowly and unequally as to be of little help in solving a problem that is immediate and insistent.

There is a third possibility which, in my opinion, evades many of the difficulties inherent in either of the alternatives just described, including constitutional obstacles to federal regulation. This plan would divide the field between the federal government and the states, the federal government to have control of the exploitation of all forests of national importance for watershed protection or national defense, and the states to assume the regulation of all other forests, *but with the active advice, guidance, and financial help of the federal government through an extension of the principles of the Clark-McNary Act.*

Because of the important influence of protection forests on navigable streams, there is little question as to the constitutionality of federal regulation of such forests. In most countries, public control has started with protection forests; and in America the pronounced public conviction on the importance of such forests would give powerful support for reasonable federal control. Under such control, the government would designate protection forest zones, in which it would control the methods of cutting. Public purchases of protection forests would be centered in these zones, and would be largely increased in order to relieve those who were unable to carry out proper cutting methods. As an offset to the added cost entailed on the private owner by federal control, the federal government should bear a larger portion of the cost of highway construction and forest fire protection than it bears elsewhere.

In the case of other forests, the Clark-McNary law could be modified or supplemented with another act to provide for financial and other coöperation between the federal and state governments in creating and carrying out state regulatory legislation. At present, the federal government is practically in a neutral position toward state regulation of forest exploitation. Under the proposed amendment, the Forest Service would take the initiative to encourage state control measures. In groups of states having similar problems, the government would promote inter-state compacts, as provided in the federal constitution. A recent precedent for such federal leadership is found in the Oil Conservation Board, which is actively advising and assisting the states in framing legislation for the regulation of oil exploitation. Federal financial coöperation would take the form of helping to finance the cost of inspectors, local and state forest boards, educational work, demonstration forests, and similar efforts. Aggressive leadership and financial assistance by the federal government would overcome the apathy, neutrality, and indifference of many states, and would lead to a systematic development of public control adapted to local conditions.

Participation versus Prescription

The legal and constitutional obstacles to control are only a part of the trouble. A further obstacle to an acceptable system of control has had to do with the ways and means of enforcement. Regulation has been too much linked up with a dictatorial inspection system and with minute regulations prescribed by a distant and presumably unsympathetic bureaucrat, who must have a sort of omniscience to prescribe for any and all conditions, with a guarantee of complete efficacy.

Neither the dictatorial inspector nor the bureaucratic prescription is necessarily the dominating feature of a system of public control. There must, of course, be "teeth" in any regulatory system, and there must be inspection. But for American conditions, it is essential that forest regulation be carried out with a large degree of democratic, local participation, partly through a system of official regional and local boards which would employ and control their own inspectors, partly by the further organization of the forest industries and owners into an effective coöperative mechanism.

In general, instead of minutely prescribing the methods of cutting, the official agencies would put the burden of choice on the landowner. There would be a general requirement that forest land could not be cleared except through special permit and that forests must be so cut or protected as to permit satisfactory restocking, or else must be artificially planted. Doubtless there would be set up guiding standards of satisfactory restocking adjusted in intensiveness to the different grades of forest soil, and in the case of large tracts the easiest procedure would be to require approved management plans from the owners. But the owner would be free to work out his own methods, and would doubtless be impelled to obtain proper technical advice. In some cases large owners would employ foresters or retain consulting foresters. In others, associations of organized owners would undertake this service. For farmers and other small owners, the educational services outlined in the last article would be available, including the results of demonstration forests. Perhaps most important of all, the local forest boards would employ inspectors who would also be advisors and demonstrators.

Even in the case of federal control of protection forests, though the prescription of definite exploitation methods might be more arbitrary, there still would undoubtedly be a need for cooperative advisory boards, somewhat similar, for example, to the grazing advisory committees in the National Forests.

The Principle of Differential Control or Local Adaptation

Another difficulty in the way of visualizing rational control has been the unnecessary assumption that such control would be inflexible and arbitrary, exacting and unreasonable, and that it would fail to allow for local handicaps. On the contrary, a system of localized control, with democratic participation, would have precisely the advantage of taking account of these local conditions, reinforced by the principle of differ-

ential standards for different forest types and grades of soil. It is unnecessary to visualize a complete and perfect system of silviculture springing at once from public regulation as Athena sprang full-grown from the head of Jove. Development of regulation will rather be a varying and localized process, rapid in some places, slow in others; working always from the simpler to the more difficult; here taking the form of better fire control; there putting the emphasis on selective cutting; elsewhere again dealing with some particularly destructive logging process; but everywhere composed in part only of stark compulsion and everywhere with a very large ingredient of coöperation, advice, education, demonstration, consultation.

Thus would be set up agencies and processes to bring a conscious consideration of improved ways of handling the forest. This is the antithesis of the *laissez-faire* approach, which sets up vague and indirect incentives, but rarely gets down to actual local problems. Organized control, on the other hand, deals with the specific case, the actual local problem, in a spirit of finding the best feasible remedy, and with the faith that as men deal with these cases and problems they will undergo a process of self-education, in the course of which the whole psychology and approach of owners and managers, lumberjacks and woodsworkers in general, will be changed from one of indifference to one of positive effort.

Why Boards?

A system of local forest boards, by counties or other local units, is probably the most workable system, though not necessarily the only one, nor perhaps universally suitable.

The board has two great advantages: It permits democratic participation and it promotes local responsibility. The straight bureaucratic system of inspectors appointed by a central authority has neither of these advantages.

Experience with ineffective committees causes some people to doubt the advisability of depending on boards for active work. There is, however, a great difference between a voluntary, unauthoritative committee and an officially appointed board holding public commissions, bound by oaths of office, endowed with defined public functions, and backed by public authority and law. The American people are accustomed to the functioning of such boards—such, for example, as selectmen, county commissions, tax assessment and appeal boards. The gigantic task of administering the draft law fell primarily upon the local draft boards (with federal power, of course).

There is another special reason why the board form of control is needed. In controlling methods of exploitation, the boards will exercise quasi-judicial functions as distinct from purely administrative functions. President Hoover has clearly defined the distinction between these functions and the corresponding type of organization needed to discharge them:

"All executive and administrative functions should be separated from boards and commissions and placed under individual responsibility, while quasi-legislative and quasi-judicial and broadly advisory functions should be

removed from individual authority and assigned to boards and commissions".

The Functioning of the Local Boards

How will a local forest board function? One of its main duties would be to give advice and assistance to forest owners. To this end, either alone or in coöperation with neighboring county forest boards, it would employ a trained forester, who would help the individual forest owner in such problems as fire control, slash disposal, thinning, selective cutting, planting, marketing, sale contracts, management plans, protection methods, and the like. Besides working with individual owners, the board would organize associations of forest owners and industries and stimulate them to deal constructively and responsibly with local forest problems.

With the assistance of these associations, the board would work out codes of logging and utilization practice to assure forest reproduction. It would deal progressively with the most outstanding undesirable practices, such as uncontrolled fire, unregulated slashings, unrestricted clear-cutting, destruction of advance growth in logging, lack of seed trees, cutting and turpenting of young timber, and skimming off the best and leaving the worst, which as inevitably leads to a worthless forest as does straight devastation.

The board would be a clearing-house for the dissemination of educational material, for lectures, exhibits, forestry fairs, contests, discussions, conferences, meetings, demonstrations, "axe-meetings", and all other means of cultivating intelligent understanding of and interest in silviculture. It would take the lead in coöperative and community forest enterprises, such as establishing local nurseries, gathering seed, selling planting stock, developing coöperative marketing and integrated industries, promoting town and county forests, and carrying out forest improvement and protection programs. In short, the board would be the means of organizing, stimulating, and setting to work on forest upbuilding whatever of interest, intelligence, and good will was locally available.

In enforcing required measures, the board would, of course, have broad legal authority, but the owner should have the right of appeal to the courts against a decision of the board.

Is the Time Ripe for Organized Control?

The principle of differential control, which will take full account of regional and local economic and physical limitations, is the main answer to this question. This principle, in effect, means that instead of waiting for a millenium when uniform control is possible, we shall start with things as they are, do the best we can in the light of local conditions, and frankly expect rapid progress in some places and halting progress in others. The advance of public control would thus be somewhat analogous to the advance of coöperative fire control.

When we face the facts and the history of forestry, we are forced to recognize the foredoomed failure of radical individualism in dealing with the pri-

vate forest problem. It is essential, therefore, that we begin now to build up a system of control. When, after the Civil War, there was infinite debate and long delay over the resumption of gold payments in lieu of inflated greenbacks, the Secretary of the Treasury tersely cut the Gordian knot with the remark, "The way to resume is to resume". The way to begin the control of forest exploitation is to begin. In fact, it has already begun: In Idaho, Washington, Oregon, and Maine, for example, with compulsory slash disposal or compulsory fire patrol, or both. But it does not exist as a national coördinated movement and therefore must be rapidly extended and developed as far as economic conditions permit. Such control will be no more difficult to attain and enforce—in fact, probably less difficult—than the proposed control of lumber production which the lumber industry itself has petitioned the government to permit. And, in fact, the same machinery that will be used to control production can easily be made a part of the machinery to control exploitation.

This series of articles has set forth what may be called a positive philosophy of forestry as the basis for a new approach to the private forest problem. Let us briefly restate its chief principles.

Declining wood consumption is primarily due to forest destruction and gives no real justification for relaxing efforts to prevent deforestation.

The let-alone or *laissez-faire* policy of leaving the private owner free to devastate his forest—a survival of 18th century economic and political thought—is unworkable, is socially disastrous, and is out of harmony with the widespread modern trend for the constructive control of economic processes. It must be replaced by a policy of direct control of the processes that cause forest destruction.

Our basic problem is that of changing human habits. To that end, it is not enough merely to create vague and distant incentives. The key to rapid advance in silviculture is to deal directly with destructive logging, which is composed of steps susceptible of remedy and which must be replaced by "silvicultural logging".

In remedying destructive logging there are two main steps. First, there must be a great intensification of education, demonstration, and research, designed to make silviculture as a *process* known to all forest owners, and to train foresters themselves more adequately in the transition between logging and silviculture; and there must be definitely organized coöperation between the government and the principal forest owners and industries to remedy destructive methods. Second, there must be a reasonable public regulation adjusted to local conditions and handicaps and carried out with local responsibility and with the participation of forest owners. This regulation must be shared by the federal government and the states, but with the federal government taking an aggressive lead because the problem is a national one.

These principles of action are based on recognition of the unlimited creative capacity of civilized man. Forest destruction is a symbol of political, industrial, and social incompetence. Silvi-

culture is a symbol of a higher and more orderly civilization. The solution of the forest problem depends far more on intelligence, will, and good workmanship than on economic predestination. Silviculture will be possible in America when we deal directly and realistically with forest destruction as a process composed of steps amenable to reform.

EDITOR'S NOTE: This is the last of a series of four articles by Mr. Shepard.

"Socially considered, the conservation movement is symbolic of the fact that, as a people, we are in a kind of twilight zone between the exploitation of the American continent and the enrichment of an American culture, using the term culture in the broad sense of the whole fabric and feel of American life. . . . .

"For the conservation movement is nothing less than the guidance of American civilization in its transition from its pioneer youth of short-sighted exploitation to its productive maturity of statesmanlike development".

—(From *American Forestry.*)

GLENN FRANK,

President, University of Wisconsin.

TEACHING SILVICULTURE

By SAMUEL N. SPRING

Professor of Silviculture, Cornell University

"There are more ways of killing a cat than choking her on butter." *Old proverb.* The author here describes briefly a method of associating the factors influencing growth and reproduction with the specific standard practices of silviculture in teaching this subject. It is an endeavor to get students to draw freely on fundamental courses, to encourage discussion and analysis rather than to administer silviculture to them by the funnel method.

YEARS AGO when the lecture method was at its height one of my students once remarked, "Professor, my notes in forest ecology strongly resemble the Book of Proverbs." That remark gave me pause and was the basis for a complete change in teaching silviculture in so far as natural regeneration and development of the forest were concerned.

Silviculture at best is a difficult subject to teach well. A fundamental course in forest ecology by itself is interesting to the teacher and to a few of his students who may like, so to speak, to study the wheels and springs that make the watch go. For the majority of students, however, the factors by themselves, — climatic, physiographic and biotic,—are a bore. I found that once such a course was passed factors were forgotten, since they had no special association even if illustrations had been given. I therefore conceived the idea of teaching the foundation and the art in one course. Omitting the teaching technique of seeding and planting, which is well known, the following statement indicates without unnecessary elaboration the way in which the art is taught.

Silviculture Course A

Standard methods of silviculture used in reproducing forests naturally and in the development of forest crops.

Textbook — Hawley's "Silviculture."

Purpose and procedure — Broadly, this course is a study of standard methods and the environmental factors before, during and after application of the silvicultural method employed, including both reproduction and intermediate cuttings. The purpose is to associate methods of practice with environmental factors. Mode of procedure is by quiz and discussion.

Outline of Indoor Periods

(Commonly called lecture periods)

Basis — Principal fundamental courses during the first two years, such as chemistry, botany (general botany, plant physiology, and forest botany), geology, meteorology, entomology (general entomolgy and forest entomology) soils, pathology, economics and a course in the study of timber trees, including silvical characteristics, types and regions.

I. *Introduction*—The environmental

factors, classified, explained and discussed. (Basis—Chapter I, Toumey's "Foundations of Silviculture" and other references.) 1 or 2 periods only.

II. *Natural methods of reproduction (following textbook)*

A. *By seed*

1. *Clear-cutting method*

(a) *Details of the method.* Recitation, one problem, and discussion of this standard method with the purpose of thorough acquaintance with this mode of regeneration. (Following the textbook.)

(b) *Conditions before and after cutting.* (1) Conditions bearing on seed and seed supply; (2) Conditions governing germination; (3) Conditions governing growth. The discussion method is followed, taking up the topics with reference to groups of factors, (climatic, physiographic and biotic) and separate factors within the groups. The elements of "succession" are brought out. Discussion is based on fundamental courses previously taken by the students and on assigned reference for the whole class and references for special report by individual students. The objective to be attained is a clear understanding of the factors at play during regeneration, *thought out* by the class in session, rather than *told* to the class. Discussion of conditions governing growth (b-3 above) leads to

(c) *Natural development of the stand.* Without consideration of intermediate cuttings the development of an even-aged stand derived by clear-cutting is followed through from its inception to maturity and, as above, the changes in environmental factors considered in each stage. Divisions (a), (b), and (c) require many class periods and include many references for study aside from textbook.

2. *Seed tree method*

After the details are understood this method is then compared with the clear cutting method particularly to discover resemblances and differences in any environmental factors and conditions.

3. *Shelterwood method*

Contrasting of this method with previous methods becomes possible as soon as the details are mastered. Through study and discussion of the factors as they operate before and during the regeneration period, the fundamental reason for gradual opening of the crown cover is evident.

4. *Selection method*

The study of this method, similarly, brings out clearly the conditions under which trees or groups develop from seedling stage to maturity and the factors involved. Contrasts with previous methods readily come out in discussion.

B. *By sprouts*

1. *Coppice method*

2. *Coppice with standards*

In these two methods the procedure is the same as in A, excepting that the origin involves sprouts and seedlings.

III. *Intermediate cuttings*

The details of each type of cutting are learned by study of textbook. Discussion and reports on special assignments bring out the factors involved in the various cuttings, the conditions and

the effect on the crop in its development.

IV. *Standard methods in managed forests in Europe.* (The application of silvicultural systems). A short series of lectures illustrated by slides to review and visualize stages of reproduction and bring out more clearly fundamental principles of standard cuttings. (The students are given assigned readings in Troup's "Silviculture"). Discussion is encouraged and quizzes are given. The basis of this section is the data and photographs obtained by the author in typical European forests. It also shows the flexibility in application of silviculture and possibilities of combination.

V. *The site factors*

This section of the course is devoted to consideration of the principal site factors in their influence on the forest and vice-versa, gathering together in coördinated form much covered in previous study and discussion in the course. Succession receives special consideration.

Out-door Periods

(Commonly called field work)

No fixed yearly program of cut and dried procedure is used. It consists of silvical studies that require the securing of definite data following exact methods. Crews of two or three are formed to do the work which may be outlined or it is put up to the crew to formulate a plan of procedure, approved by the instructor. The purpose is to teach analysis of conditions and drawing of independent conclusions, weighing the factors involved. The whole is incorporated in a report or where one theme covers several field periods a final report is required. (Practice in the application of silvicultural methods and simple research projects are covered in the summer camp in the Adirondacks, covering one month prior to the senior year and in field work on the Arnot Forest in the course described below.)

Silviculture Course B

Application of silviculture to principal types and important species in the United States.

Basis—"Timber Growing and Logging Practice" reports of U. S. Department of Agriculture, and other assigned references.

Procedure—Oral reports on assigned references, quiz and discussion in class periods of two and one-half hours each. Special emphasis is given to economic considerations. Small sections are essential since too large numbers of students cannot satisfactorily be handled on this plan. The informal method of study has been used, that is, individual directed study, (no class work), weekly individual conferences with the instructor and final comprehensive examination at the end of the term. I have found this method very valuable, time consuming and applicable especially to students whose grades are normally "B" or better. Others than these work better under formal class requirements.

Field and laboratory work—This has been described above and in inclement weather is in the laboratory, working

on data taken in camp or on the Arnot Forest.

Although the description of these courses is without full detail and outline, I have presented it in the hope that teachers of silviculture may be encouraged to try out new methods of instruction that may bring out the individual ability of students, increase original thinking on their part and serve to ground students in the analytical method of approach to future problems that they may encounter.

The total membership of the Society of American Foresters on December 23, 1930 was 1,740, distributed as follows:

Fellows	11
Senior Members	708
Junior Members	949
Honorary Members	14
Corresponding Members	6
Associate Members	52
Total	1740

THE 25-25-50 RATIO IN FINANCING FIRE PROTECTION

By FRED MORRELL

Chief, Branch of Public Relations, U. S. Forest Service

This appraisal of results of federal coöperation in fire protection under the Clarke-McNary Act reminds us that the problem of forest protection is by no means fully solved. Light is thrown on the direction toward which further efforts must be made before reasonable efficiency can be attained

MOST FORESTERS are familiar with the language of Section 2 of the Clarke-McNary law of June 7, 1924, which provides that "The Secretary of Agriculture . . . . is authorized and directed, under such conditions as he may determine to be fair and equitable in each state, to coöperate with appropriate officials of each state, and through them with private and other agencies therein, in the protection of timbered and forest-producing lands from fire," and with the additional provision which specifies that federal cooperation shall not exceed the amount paid by the states and other coöperative agencies.

Perhaps all are acquainted too with the concept that as a broad general principle private owners should contribute one-half of protection costs and that the public's half should be divided equally between federal and state governments. On this premise the federal government's share was estimated to be $2,500,000 and the law authorizes appropriations of not to exceed this amount. Some idea of how the arrangement is working out, or is not working out, may be of interest. Total expenditures during the calendar year 1929 were, in round figures, $5,800,000, or 58 per cent of the original estimate of $10,000,000 needed for protection. Of this the federal government paid 21 per cent, the states 48 per cent, and private owners 31 per cent.

Uncle Sam, it will be noted, was dragging his feet by 4 per cent in actual allotments to the states, though if the percentage retained by the U. S. Forest Service for administration of the Act, which must come out of the $2,500,000 authorization, were added he would be shown about that much ahead. Private owners are behind by 19 per cent and the states ahead by 23 per cent.

It was, of course, not expected that the ratio would work out exactly. Neither was it expected that there would be any consistency in the division of state and private funds. From the start the Forest Service allotted to each state able to match it a definite percentage of the total estimated needs (9 per cent in 1929), and distributed the remainder of the appropriation in accordance with the amount by which the actual expenditures for fire prevention in each state exceeded the 50-50 sum.

But totals for all of the 38 states with which the federal government coöperated in 1929 are not particularly significant. Administration of the Act requires individual contracts with each state, and progress in each is measured

by what happens within its borders. The following analysis will serve to give a more accurate picture of how the Clarke-McNary law is working out:

Number of states in which the federal government contributed more than 25 per cent in 1929	19
Number of states in which the states contributed more than 25 per cent in 1929	28
Number of states in which the private owners contributed 50 per cent or more in 1929	5
Number of states in which private owners did not contribute in 1929	15
Number of states in which states did not contribute more than cost of protecting state-owned lands and central overhead	12

In 15 states all costs were borne by the public and in 15 others the state and federal governments together paid more than 70 per cent of the total.

Viewed from the standpoint of the United States as a coöperator in the protection venture, it is not important which of his two partners matches his money, but it is of consequence that his associates once having set their hands to the plow do not turn back, and that, in the writer's judgment constitutes a most serious question regarding the success of the coöperative undertaking.

The five northwestern states are those in which private effort is in excess of 50 per cent of the total. They contain the great bulk of privately owned timberlands west of the Great Plains. Years before the passage of the Clarke-McNary law, private owners organized to protect their timber and improvements from fire. In order that those who were disposed to ride free might be made to do their share, they (the land owners) secured the passage of compulsory patrol laws in the four most important states. Protection of virgin stands necessitated preventing and suppressing fires on cut-over lands. As funds became available under the Clarke-McNary law, federal and state officials recognized the necessity of using them so far as possible to assist in protecting cut-overs. The United States staked its money on the hope that federal and state assistance plus the owners' necessity of giving cut-over land some protection to save commercial stands would serve to tide the land over till the owners of young growth would recognize enough values in it to continue their share of the protection costs. I believe that anyone who faces facts and probabilities squarely must agree that the prospects are none too bright for continuous protection by private owners over a large percentage of these western lands. The broadcast burning of slash generally practiced until the last few years, and still practiced on a large portion of present operations has left the land without residual stands, and a bad fire hazard, and repeated burns have prevented full restocking on much of it. A considerable number of operators have now discontinued broadcast burning, and are making earnest effort to restock their lands, but they are as yet in the minority. The result is that a large percentage of land cut over to date has little to show in the way of advanced young growth, and some of it not much to show in seedlings, or of seed trees from which to grow them.

Perhaps most of the land will restock in time if fires are kept out, but it is a long time to wait for a crop, and the land can be bought at prices ranging from transfer charges up to $3 or $4

per acre for well-stocked pole stands. It seems fairly obvious that the average man is unlikely to pay carrying charges in form of taxes and fire protection of from 10 to 25 cents per acre on land that no one will take off his hands at more than 25 cents to $1, and that the urge to let go of it is likely to be overpowering when he gets to the point in his operations that he can do so without endangering his other property. Increasing tax delinquency is the "proof of the pudding".

In two of the five states the legislatures have recognized a state interest in protecting cut-over lands and are furnishing a small share of the cost. In three of the five, remedial tax legislation has been passed. In the other two the land owner has no way of estimating what his taxes may amount to before he can bring a forest crop to maturity. The weak points of the system are that the federal government, primarily interested in growing new forests, is coöperating with land owners mainly interested in saving commercial stands till they can be liquidated, and the state, holding the balance of power through tax and police authority, is making little or no investment in the project.

In those states where a substantial portion of total funds is being paid from general state revenues protection seems to be on a firm foundation, and where that condition exists and protection is in effect over the larger portion of forest land the venture seemingly may be regarded as "over the top," or if not that, on the way to success. The coöperative understanding has been described as a three-legged stool which cannot stand unless all three legs function. Personally, I think the stool can get along nicely on two legs or even one provided it is the right one and the necessary leg is the state. The state can carry on protection successfully without either of the other partners. A number of them were doing it before the others appeared. The state can, therefore, succeed with assistance from either the federal government or the land owner, or with both of them, but the other two cannot get along without the state, because, as stated above, power to make or break the venture through laws and their enforcement lies in the state.

In about fifteen states the federal government is supplying approximately one-half of all funds expended. In most of these the states are advancing most of the remainder and private contributions should be reasonably stable because they are advanced for the protection of second-growth stands. But in a number of states the total state appropriation is not more than enough to carry centralized overhead, leaving federal funds as the only "outside money" available for actual protective forces. In these states, too, as I see it, there is urgent need for state appropriations to assist in actual protection, both because more is needed and because the states holding the power to draw down the "pot" should have some "chips in the game." Looking at the matter as a common sense business venture that would not seem to be an unreasonable requirement.

The project is relatively new and the writer would not wish to appear pessimistic over it. On the contrary results

to date as a whole appear to be excellent. The fact that there may be squalls ahead is no reason for quitting the ship, nor would intent to stay with it be reason for not seeking to adjust its course, or, perhaps a better statement, not seeking to steer it along the course originally charted if that still seems the most promising.

State participation in the reforestation project through suitable tax systems constitutes as direct and sometimes a more helpful contribution to protection than direct appropriation for that purpose.

The intent of this paper is wholly to point out the need for tax adjustment, or greater direct contribution to fire conrol or both, in those states which are not contributing enough to make a substantial contribution to the total protection job. At the same time, effort to increase private contributions should be continued, but it must be recognized that the owner of even good potential forest land will not in the end put more into taxes and protection than seems wise to him as a business venture, and if the public will have its forests, it must provide the rest.

DOES LIGHT BURNING STIMULATE ASPEN SUCKERS?

By HARDY L. SHIRLEY

Lake States Forest Experiment Station

Light burning stimulates the growth of aspen suckers according to a study by the author. He believes the stimulation to be due to the increased heat absorption of the blackened surface.

THREE PLOTS were established on the Chippewa National Forest in the fall of 1929 to study the possibilities of converting aspen lands to conifers. Forty-three-year-old aspen grew in a dense stand on each plot. On one the aspen was clear cut. On another 35 per cent of the basal area was removed, while the third remained uncut. One phase of the plan was to study what effect a light fire, just hot enough to kill all the underbrush, might have in encouraging planted conifers. Accordingly, four quadrats, ten feet square, were burned over on each plot, using a commercial brush-burning torch. The burning was carried out in the late fall after most of the leaves had fallen. The older layers of leaves were wet so that only leaves of the past season were consumed in the fire. The burning did not warm the mineral soil appreciably. Burned quadrats were alternated with unburned check quadrats. Twenty-five white spruce and twenty-five Norway pine were planted on each quadrat. When examined one year later no significant difference in survival of the planted conifers could be detected on the burned and unburned quadrats.

A luxuriant growth of herbaceous plants came up in the spring on both burned and check quadrats, indicating that the fire had been very light. Stems of shrubs subjected to burning failed to leaf out, so must have been killed by the heat. A profuse crop of aspen root-suckers came up on the clear-cut plot and some on the others.

On September 13, 1930, each aspen root-sucker was measured on every quadrat. The average number of suckers per quadrat and the average height of the suckers are given in Table 1.

The original data were treated by Student's[1] method to determine if the differences between the burned and check quadrats were statistically significant. Expressed as odds it may be seen that only once in fifty trials, due to chance alone, would a difference of thirty-three suckers occur between two sets of four quadrats on a clear-cut aspen plot; on the other hand it is seen that the difference in number of suckers on the partially cut and uncut plots might readily have been due to chance, so cannot be considered significant. The writer does not care at this time to dwell on the differences in numbers of aspen suckers produced by different degrees of cutting except to point out that partial cutting produced only a few more than occurred on the uncut plot,

[1]Fisher, R. A., Statistical Methods for Research Workers, Oliver & Boyd, London, 1928.

TABLE 1

ASPEN ROOT SUCKERS ON BURNED AND UNBURNED QUADRATS

September 13, 1930

Datum	Clear-cut area		Partially-cut area		Uncut area	
	Burned	Check	Burned	Check	Burned	Check
Number of suckers per quadrat (Mean of 4)	133.5	99.75	14.5	8.75	7.5	8.75
Excess in favor of burned	33.75		5.75		—1.25	
Equivalent number per acre	58,150	43,450	6,300	3,800	3,250	3,800
Mean height of suckers feet	3.53	3.22	2.25	1.67	2.43	1.97
Increase on burned feet	.31		.58		.46	
Maximum height of suckers, feet	8.5	8.0	6.5	4.0	5.5	4.0
Odds, differences are significant—						
In numbers	50 to 1		3 to 1		1.2 to 1	
In height	100 to 1		50 to 1		20 to 1	

while clear cutting caused their optimum development.

The average height of the suckers was greater on the burned quadrats of each plot and analyses shows that these differences may safely be attributed to the effect of burning. How can this difference be explained? It is not believed that the slight heat of the fire in the fall had any effect on the growth of the suckers the following spring. Two other possibilities suggest themselves: 1. Mineral salts liberated in the ash stimulated growth, 2. the burned quadrats were warmer. The first explanation loses weight upon more critical study. Suckers do not come from the fine absorbing roots but further back on the large laterals. Suckers develop only an insignificant independent root system the first year, hence whatever growth they make is determined largely by their utilization of materials from the old root system. Since the quadrats were only ten feet square any fertilizing value of the ash should appear on the large roots which had absorbing roots on the quadrats. Since burned and check quadrats alternated the fertilizing effect would be likely to appear on both.

The more plausible explanation seems to be that the blackened surface absorbed more heat than the unburned surface, hence causing the soil to warm up earlier and remain warmer during the early part of the growing season. The increased soil temperature would stimulate chemical activity in the old roots, thus making the stored food more rapidly available for the suckers. As the table shows, the effect would be less pronounced on the shaded plots since less sunlight reaches the soil. Soil temperature accounts in part for the greater growth on the clear-cut plot than on the others where the surface temperature was from 8 to 10 degrees C lower and the temperature at 6 inches depth from 1.5 to 2 degrees C lower.

SUMMARY

The growth of aspen root suckers was found to be stimulated by light burning. This stimulation is believed to be due to the increased heat absorption of the blackened surface.

VISIBILITY MAPS BY FIELD SKETCHING

By H. M. SHANK,

Associate Civil Engineer, U. S. Forest Service, Ogden, Utah

The value of lookout stations as primary detection systems is well enough appreciated but often too little is known of their individual or collective visibility efficiency. Without an investigation of the area actually and directly visible, selection of lookout stations cannot be intelligently made, and the effectiveness of an existing system may be overrated. The author discusses the effectiveness of lookouts, shows how a visibility survey can be conducted, and compares the several methods. Where topographic maps are not available he finds direct field sketching to yield very satisfactory visibility maps at low cost.

ANY SYSTEM of fire protection on the national forests must be based primarily on the lookout system, and the effectiveness of protection will depend to a large extent on its efficiency. Among the factors determining the net efficiency of a lookout point are direction and velocity of wind, general atmospheric conditions, attentiveness of the lookout man to his job, and the amount of seen and unseen area within range of the station. Control over the first two is not possible, nor over the last except by selection of the best points. The matter of selection is not as simple as it might appear on first thought, and cannot be determined by snap judgment or by inspection.

The area seen and unseen from a given point may be determined by any one of three methods provided satisfactory topographic maps are available. They are: 1. by plotting profiles from the contours of a topographic map; 2. by preparing a relief model from a topographic map and determining seen areas by a light and shadow method; and 3. by field sketching from the lookout points.

By the first method there results a series of cross sections of the earth's surface radiating from the lookout point at suitable arc intervals to define the seen and unseen areas. At distances not exceeding ten miles, profiles may be platted on each 2.5 degrees of arc and as distance becomes greater the arc intervals are reduced, so that at 20 miles, profiles would be platted at about one degree intervals to define with suitable accuracy the seen areas.

By the second method, a relief model showing the area to be studied in miniature, is made from the contour map. A description of relief model preparation is beyond the scope of this paper. After the model is completed, a small light (surgeon's or flash) is suspended with the globe on the point representing a lookout station, in a dark room. The areas which are in shadow will be the territory not seen by the lookout.

Theoretically, both of these methods can be worked out in complete detail in the office. Practically, they should be studied in the field with relation to routes of travel, existing and proposed, and particularly with relation to difficulties of terrain which will not show in miniature. After a composite seen-area

map from a group of lookouts has been made, the second method is particularly valuable in showing where additional lookouts should be placed, to afford the required visibility, simply by shifting the light from point to point and observing the light and shadow effect.

As has been noted, both of these methods are dependent on the availability of topographic maps, and unfortunately these are sadly lacking for most of the Intermountain Region, and the same condition may be expected to continue for some time. Much of the mapping completed is in the nature of reconnaissance surveys and on a scale too small for this work. Only about 19 per cent of the State of Idaho is mapped to a satisfactory standard and it is in this state where visibility maps are needed for Region 4 of the Forest Service.

In the meantime, the Forest Service is charged, among other things, with the protection of forests from fire, and as a means to this end, visibility maps have been made for years by various methods and with varying degrees of accuracy. It is no reflection on anyone to say that many of these were not of much value. Up to about 1922 much of the central Idaho region was not mapped except by the crudest methods. This situation is now relieved for all the hazardous fire areas, to the extent of having drainage maps which, in point of accuracy and amount of detail, are comparable to or better than U. S. Geological Survey quadrangles published on a scale of one-half inch to a mile. Since 1922 the Forest Service has mapped 6,367 square miles in the area south and west of the Salmon River in Idaho. This work was done principally for the purpose of improving fire detection and suppression performance.

In 1928 the Forest Service began a study of transportation systems suitable to the national forests and it early became apparent, particularly with reference to trails, that much necessary data on visibility or degree of visibility were lacking. It is quite amazing to note in various papers, bulletins and other publications how little attention is paid to visibility. Much of what has been written about hour-control passes it by quite casually.

It became apparent that if anything definite were ever to be accomplished, a systematic method of determining seen and unseen areas would have to be worked out, based on available maps. In order to make sure that such visibility maps were satisfactory there had to be some sort of "yardstick" by which their accuracy could be measured. A visibility map made from a relief model appeared to meet this condition.

The writer was detailed to make such a study in 1930, and selected the Loon Creek Ranger District, Challis National Forest, Idaho, for the site, as it is the only ranger district or administrative unit in central Idaho which has been topographically mapped, and hence the only one for which a relief model could be made. Preparation of the model began at about the same time as the field sketching and both were completed about the same time.

The definitions of the three classes of visibility now in use are as follows:

Direct: Area on which a fire can be discovered in Class A stage (Class A fires are less than one-quarter acre in extent).

Indirect: Area on which a fire can be discovered in Class B stage (Class B fires are more than one-quarter acre, but not more than 10 acres in extent).

Unseen: Area on which fires cannot be discovered until they reach Class C stage (more than 10 acres).

These definitions are good as far as they go, but they do not answer the question *of what these areas are.* How far away can a fire in Class A stage be discovered with the ground or ground cover visible? How far, if the fire is 200 feet down the opposite side of a mountain from the lookout? One thousand feet down? What are normal fire season conditions, if any? What effect would a strong wind have on discovery with smoke drifting? What is the effect of light conditions in the early morning and late afternoon with reference to discovery?

The definitions just given do not establish anything definite on which a map can be made, as they may have an unlimited number of interpretations. In consultation with other forest officers the following definitions were decided upon as a basis for the study. They are for average conditions:

Direct: Areas within 10 mile radius on which the ground or ground cover is visible.

Indirect: Areas within 10-mile radius not more than 200 feet vertically under the line of visibility. Areas between 10- and 20-mile radius on which the ground or ground cover is visible.

Unseen: Areas within 10-mile radius more than 200 feet under the line of visibility. Areas between 10- and 20-mile radius not visible. All areas beyond 20-mile radius.

These are arbitrary divisions and cannot meet all conditions. They were believed to fit generally conditions for the area being studied and define the areas in which fires could be detected in Class A, B and C stages, respectively. There has been no reason to revise these definitions since the work was completed, except that it does not appear practicable to determine the location and size of areas from zero to 200 feet under the line of visibility by field sketch methods or from a model. Such areas can be determined from profiles. However, an attempt was made to sketch such areas. In a region of high relief, such as this was, they consist of a very narrow strip closing around each seen area, the total of which would be an extremely small percentage of the entire area under consideration. With low relief these areas would increase until they might be a large percentage of the whole. However, it is perfectly obvious that if the sketcher cannot see an area, he cannot determine by *how much* he cannot see it.

Therefore, these areas were not considered in compiling the data from field sketches for comparison with those from the relief model. The tabulation for purposes of comparison were based on two definitions only. They follow:

Direct: Areas within a radius of 20 miles on which the ground or ground cover can be seen.

Indirect: Areas within a radius of 20 miles on which the ground or ground cover cannot be seen.

They are intended to represent areas in which fires can be discovered in Class A and B stages, respectively, *provided* the composite direct areas amount to not less than 50 per cent of the total area

nder consideration. Failure to detect ires until they reach Class C proportion s not considered. Any fire organiza- ion on such a basis is unthinkable.

This percentage may be too low for reas of extremely high relief and too igh for areas of low relief. It is be- ieved a system up to this standard for he area mapped would be satisfactory. From careful observations on this area, t is highly probable that a lookout sys- em located so as to see a minimum of 50 per cent of a given area, will in fact ee considerably more than that; that is, t is not possible so to locate a number f lookouts as to see *only* 50 per cent of he area without deliberately selecting ookout points which are not the best.

The term "average conditions", as de- ined for the purpose of this study, de- erves some further consideration, not vith the idea of splitting hairs, but for he purpose of setting up a standard of erformance for lookouts. It is defined s follows: Average conditions obtain vhen the side of a mountain or its round cover can be distinguished at a istance of 20 miles. This definition is pen to a lot of criticism, without doubt, ut is believed to fit fairly well the egion to which it was applied.

Each lookout is required to report on onditions to a superior officer twice or nore a day. Some well-known land- nark at a distance of about 20 miles ould be selected for each lookout to erve as a gauge of general atmospheric onditions, and to determine whether verage conditions prevail. When these verage conditions exist the lookout ould and would be expected to detect ires as indicated in the two definitions ast given. Without satisfactory visi- bility maps it is difficult to establish responsibility for failure to detect fires under certain conditions, nor would this method be fool-proof, but with these points impressed on each lookout it probably would result in better detection performance.

The writer and one man who acted as cook and packer comprised the sketching party. Two saddle and three pack horses were used, permitting of two men remaining away from a base of supplies for a month or more. Instrumental and other equipment included: Gurley telescopic alidade with 18 inch base, 18x24 inch plane table, extension leg tripod, pens, pencils, and the like, one map for each lookout from the administrative map of the forest on half-inch scale mounted on muslin, showing drainage and culture but no contours; two small tents, cook outfit, sleeping and duffle bags, horseshoeing outfit with extra shoes, and provisions.

Sketches were made after the general method employed in making topographic surveys by the plane table method except that no points but lookouts were occupied. The plane table was oriented by observation on distant known points, with checks on others. Seen areas nearby were sketched first, the limits of a seen area from side to side being sighted in with the alidade. Determination of the limits of a seen area in the direction of the line of sight is dependent largely on the judgment of the sketcher and his ability to read maps and identify distant points of the ground. This might be termed "topographic sense". Experience and skill in the use of a plane table and alidade as applied to topographic mapping is a

distinct advantage and almost a necessity in the performance of the work.

As this survey was made to determine whether satisfactory visibility maps could be made by field sketching on a drainage base map, that class of map was used, although topographic maps were available. The conclusions therefore should be sound for maps under the same conditions elsewhere.

Map sheets 18x24 inches were used, but 24x31 inch sheets would be better for future work. The lookout point should invariably be at or near the center of the sheet. The larger sheets would permit of sketching a full 20 miles (on a half-inch to the mile scale) from the lookout with ample map space to spare.

The writer had never been on or very near to any of the seven lookout points except one, and was familiar with the area only in a very general way. Sketching began on August 25 and was completed on September 13. The whole range of atmospheric conditions occurred during this time, from perfect days with only the horizon limiting vision, to days when visibility was limited to 5 miles or less in the early morning and late afternoon. On the last point, the higher elevations were lightly covered with snow.

Accurate sketching ordinarily cannot be done earlier than two hours after sunrise or later than two hours before sunset, not because distant points cannot be seen, but because the whole landscape appears to merge in a single panorama. Full advantage of the direction of the sun should be taken, invariably sketching *away* from it.

Some observations on sketching follow:

Map sheets soaked and mounted with paste will expand from 1 per cent to 2.5 per cent with the grain of the paper. Rubber cement is suggested to eliminate this distortion. The error in sketching is negligible, but it is difficult or impossible to reduce it to normal for comparison with a map not distorted.

The limits of an area from side to side may be determined with precision, if the long axis lies at or near a right angle to the line of vision, the probable error both as to position and total area increasing as the long axis approaches the direction of the line of vision. It is always difficult to determine the position of isolated points lying beyond a ridge, with nothing near on the map or on the ground with which to determine their position.

Sketching is simple wherever there is a continuous landscape, such as the face of a range or the distant side of a large canyon. The most difficult areas to sketch with any degree of certainty are unbroken stands of timber where the relief is low.

Clear days with a minimum of smoke and haze are best for sketching, in general, although under certain conditions small scattered cloud banks with resulting spot shadows are an advantage in the location of areas at a considerable distance, which under full light appear to be continuous, but with lights and shadows show up as a series of seen and blind spots. This is particularly true in extensive solid stands of timber.

The total area sketched which was common to the relief model was 1,160 square miles. *By the light and shadow method* 45.7 per cent of this area was shown to be visible. *By the field sketches*

45.0 per cent was shown to be visible. The shape and size of seen areas in both cases come remarkably near to coincidence, and for all practical purposes it may be concluded that visibility maps made by field sketching, by someone qualified and with proper equipment, are entirely satisfactory.

With this showing, the analysis of the study was based on an area of 1,602 square miles, the field sketches having covered a larger area than the relief model.

A method was devised for determining the efficiency of a lookout point from the standpoint of seen area. For the area of 1,602 square miles sketched, 40.6 per cent was shown to be seen; in others words, the total efficiency of seven lookouts is 40.6 per cent *with reference to seen and unseen areas.* Offhand it might appear that the efficiency of a lookout (on this same basis) is the percentage of area seen, which it is as long as only one is being considered, but if several are under consideration this is not true, because seen areas will be found to overlap. This survey showed the following percentages of the total area within a 20-mile radius of the lookout to be seen:

Greylock	11.4 percent
Twin	14.7 percent
Sleeping Deer	18.4 percent
Duck	14.6 percent
Pinyon	18.7 percent
Two Point	14.7 percent
Middle Fork	21.0 percent
Total	113.5 percent

or approximately 2½ times the percentage of the seven taken as a whole. The efficiency of a lookout point may be expressed as follows:

$$\text{efficiency (percentage)} = \frac{a + b + c}{d}$$

in which *a* is the area seen only by the lookout under consideration, *b* is one-half the area seen jointly with one other lookout, *c* is the area seen jointly with more than two lookouts divided proportionally, and *d* is the total area within 20 mile radius.

These areas were determined by making a composite seen area map, each lookout being shown by a different cross-hatching symbol. The areas *a* and *b* can be gotten with little difficulty. The area *c* may then be determined by dividing as many ways as necessary.

Using this method the efficiency for these lookouts was found to be as follows:

Lookout	Efficiency	Relative efficiency "Two Point"=1.0
Two Point	2.81	1.00
Duck	3.87	1.38
Greylock	5.75	2.05
Twin	6.60	2.35
Pinyon	6.67	2.37
Middle Fork	7.03	2.50
Sleeping Deer	7.89	2.81
Total	40.6	

It should be noted that if one lookout of a group is eliminated from consideration, a recomputation must be made to get the efficiency of those remaining, since both factors *b* and *c* will be changed. Also it should be noted that the efficiency of a system of lookouts for an entire forest can not be determined until complete visibility maps have been made for every lookout on the forest and every lookout on adjacent forests which have any visibility on the forest being studied.

Mention should be made of the method used in taking off seen areas

from the relief model. This cannot be done by photography since it is not a plane surface and at a point not vertically under the lens of the photographic equipment distortion will result, increasing toward the edge of the photograph. This error was avoided by placing on top of the model a piece of plate glass and painting on to it the seen areas from below. Some little displacement of seen areas occurred, but they were negligible. After completion the plate glass was placed under the photo-copying machine and such reproductions were made as needed, reducing or enlarging the scale if necessary.

The conclusions resulting from this survey in addition to those already mentioned may be summarized as follows:

1. Seen and unseen areas can be determined by field sketch methods on a drainage map accurately enough for all practical purposes.

2. Areas of varying degree of invisibility cannot be determined with accuracy either from field sketches or a relief model.

3. Degree of invisibility can be determined by profile method from a good topographic map, and more information can be obtained by this method than from a relief model.

4. The percentage of unseen area is much greater than had generally been supposed. Probabilities are that, in general, the same will be found true elsewhere.

5. Cost of visibility survey per square mile from relief model—54.8 cents.

6. Cost per square mile from field sketches—33.9 cents.

7. Cost by profile method is not known.

8. Good visibility maps will show up weaknesses in the best detection organization.

9. Field sketching should be done by qualified persons, with demonstrated skill and experience for results commensurate with the cost.

STUDIES OF SOIL EROSION IN MISSISSIPPI[1]

By J. D. SINCLAIR

Assistant Forest Ecologist, Southern Forest Experiment Station

Erosion in Mississippi is discussed. In nine sample counties the author found 27.7 per cent of the area actively eroding, largely because of improper land use. He gives some historical background to erosion, indicates its extent, and the land uses related to its causes; he emphasizes some of the losses incurred on valley lands due to erosion on the uplands and points to reforestation as the basis for erosion control.

THE NOVEMBER, 1930, issue of the JOURNAL OF FORESTRY contained an article on the general nature and scope of the erosion studies of the Southern Forest Experiment Station prepared by Lentz, Meginnis, and the speaker. The aim of the present paper is to present the results of subsequent studies. In order to give a clearer conception of the erosion problem in Mississippi, it is necessary to review briefly some of the material presented previously.

The State of Mississippi is confronted with a very serious problem of soil erosion. The fertile surface soil has been washed from hundreds of thousands of acres of formerly good hill land. Much of this land is now dissected by gullies and lies hopelessly ruined for further agricultural use. The impoverished uplands constitute but one side of the problem for the sand and other infertile material carried down from the hills has choked stream channels, ruined rich bottomlands, and killed stands of timber. Soil erosion is undermining the prosperity of county after county in what was once considered the most fertile part of the state.

This region, known as the loess-bluff and silt-loam uplands of Mississippi, extends north and south the length of the state in a narrow belt 30 to 50 miles wide and covers a gross area of about 6,800,000 acres. These uplands border the alluvial lands of the Mississippi and Yazoo rivers on the west, while on the east they grade into geological formations of marine origin.

The principal geological formation in this region is a deposit of loess of wind blown material. This loess mantles the surface 60 to 100 feet deep on the western border of the uplands in what is known as the Mississippi bluffs, gradually thins out to the eastward, and finally gives place to Coastal Plain material.

The predominating soil types formed by the weathering of the loess are the Memphis and Grenada silt loams. These soils, when exposed to an annual rainfall of from 50 to 60 inches, erode readily, and erosion is particularly rapid when the loam is underlain at shallow depths by strata of sands, laminated clays and gravels. This is specially true in northern Mississippi where the most extensive erosion has been found. In

[1]Prepared for the annual meeting of the Society of American Foresters held at Washington, D. C., December 29-31, 1930.

the western or loess bluff portion of the region, the soil is underlain by unweathered loess and erosion there is not as severe as it is farther east.

The topography throughout the region of loessal deposits ranges from gently rolling to hilly, except in the bluffs proper which are exceedingly rough and broken. This rough topography must have been developed during former eras of erosion as evidenced by the occurrence of remaining stands of virgin hardwoods.

This portion of Mississippi was settled between 1800 and 1840, and prior to the Civil War large areas were cleared by slave labor for the production of cotton. Cotton continues to be the principal money crop, but corn is extensively grown for local consumption. Due to economic conditions following the Civil War, much land was abandoned. Some of it became reforested naturally to stands of pine while other areas, on which tree growth was unable to establish itself, are usually dissected by deep gullies and ravines. The passing of the old plantation system has resulted in increased soil wastage. Large holdings that were formerly managed by the resident owners are now mostly in the hands of colored tenants. This system has not been conducive to soil conservation or farm improvement.

The erosion problem was approached by first making an extensive survey of the region. Information was obtained concerning the extent of erosion, its causes, and the factors which prevent or check soil movement. The studies thus far have been restricted to twelve counties situated in the northern, central, and southwestern portions of the uplands area.

An estimate of the extent of actively eroding land in six separate counties was given in the November article. The figures were based upon roadside tallies made by ocular estimate of the more severely eroded areas and did not include sheet erosion on cultivated land. For this reason, those estimates cannot be compared with more recent figures obtained by the use of a cropmeter. This instrument was developed by the Bureau of Agricultural Economics of the U. S. Department of Agriculture for use in ascertaining the amount of land devoted to various crops from year to year. A more accurate and detailed estimate of the per cent of eroded land and its relation to land use in nine separate counties has been obtained with the cropmeter. A summary of the results is presented in Table 1.

It can be noted that 27.7 per cent of all classes of land in the entire area covered is eroding. Assuming that the nine counties studied are representative of 4,000,000 acres of the uplands in northwestern Mississippi, at least 1,000,000 acres are eroding. These figures indicate the acuteness of the soil erosion problem in that region.

It was found that the counties where erosion is most active are also suffering from land abandonment and stationary or decreasing populations. The Mississippi county showing the highest proportion of eroded land had a decrease in population of 2,197 between 1920 and 1930, according to census reports, or a loss of 11 per cent. To the land owner this means a decrease in land values and

Table 1

SUMMARY OF RESULTS WITH CROPMETER SHOWING DISTRIBUTION OF VARYING TYPES OF LAND IN PER CENT. SURVEY RESTRICTED TO UPLAND COUNTRY.

Land Classification	Marshall County	Lafayette County	Panola County	Carroll County	Holmes County	Hinds County	Benton County	DeSoto County	Tate County	Averages
Cultivated land										
1. Not eroded	1.90	17.8	35.5	24.6	33.1	31.1	17.8	17.4	17.1	23.7
2. Terraced	----	0.1	0.8	----	0.1	0.1	0.9	0.2	0.9	0.3
3. Sheet eroded	12.6	11.5	6.4	7.3	13.8	7.9	14.0	18.9	17.5	12.2
Total cultivated	31.6	29.4	42.7	31.9	47.0	39.1	32.7	36.5	35.5	36.2
Pasture land										
4. Eroded	8.4	7.5	6.1	5.4	5.4	2.9	4.4	16.2	17.6	8.2
5. Not eroded	7.8	9.4	16.7	11.2	12.8	15.4	2.7	14.7	11.4	11.4
Total pasture	16.2	16.9	22.8	16.6	18.2	18.3	7.1	30.9	29.0	19.6
Abandoned land										
6. Eroding	12.5	8.5	4.2	5.0	3.5	1.3	14.0	6.4	9.8	7.3
7. Not actively eroding	12.2	9.3	5.5	9.2	4.9	5.5	7.5	2.7	5.5	6.9
8. Due to other causes	7.6	9.1	7.0	9.8	11.4	15.9	6.2	4.2	8.2	8.8
Total abandoned	32.3	26.9	16.7	24.0	19.8	22.7	27.7	13.3	23.5	23.0
Woodland										
9. Bottomland	4.0	3.2	4.1	3.4	1.8	2.1	5.3	4.3	3.7	3.5
10. Upland	15.9	23.6	13.7	24.1	13.2	17.8	27.2	15.0	8.3	17.7
Total woodland	19.9	26.8	17.8	27.5	15.0	19.9	32.5	19.3	12.0	21.2
Eroding, all classes	33.5	27.5	16.7	17.7	22.7	12.1	32.4	41.5	44.9	27.7
Basis for Above Figures in Miles										
Total distance traveled	212.1	182.6	115.1	153.7	195.6	213.4	89.8	135.7	83.1	153.5
11. Rivers, towns, and non-visible	41.4	30.4	27.7	40.0	34.3	72.3	3.2	19.6	11.6	31.2
Actual basis of tally	170.7	152.2	87.4	113.7	161.3	141.1	86.6	116.1	71:5	122.5

to the county and state a reduction in taxable values.

At the Land Use Conference held in December, 1930, at Jackson, Mississippi, the statement was made that Mississippi now has 19,500,000 acres of idle and abandoned lands which are suitable primarily for timber growing and grazing. Reliable authorities estimate that within the next two years 1,000,000 acres of this area will revert to the state for non-payment of taxes. The percentage of land abandonment directly attributable to erosion is not known, but our surveys indicate that there are 1,000,000 acres in northern Mississippi that will not produce enough to pay taxes this coming year, and never will unless erosion is controlled.

During the summer of 1930, topographic and cover type maps were made of portions of five typical farms in northern Mississippi. The purpose of this work was to show the condition of the land, the extent of eroding areas and their relation to abandoned land, woodland, pasture, and cultivated land. Table 2.

The areas mapped varied in size from 83 to 234 acres. The poorest farm area proved to be 71 per cent waste or abandoned land, including 21 per cent of the total area in gullies or actively eroding. The best area contains 13 per cent waste or abandoned and including only three per cent of eroding land. It is important to note that the tract showing the highest per cent of abandoned and eroding land contains the least amount of woodland, only three per cent; whereas the tract which is the least eroded is the most wooded, being nearly 29 per cent woodland. Four of the five farms are operated by the owners, a fact that is ordinarily conducive to better land management than is generally practiced in northern Mississippi.

Certain activities of man, in one form or another, are responsible for these conditions of land spoilation. The most important of these have been found to be:

1. *Improper land use.* Slopes up to 50 per cent are cleared of timber and planted to cotton or corn. Such land, especially where the loam is underlaid at shallow depths by strata of sands and gravels, should be permanently protected by a forest cover or a cover of good grass sod.

A few years of cultivation allows the top soil to wash away and the land be-

TABLE 2

DATA SECURED FROM FIVE INDIVIDUAL FARMS

Farm	Location (County)	Acres mapped	Per cent				
			Actively eroding	Waste or abandoned (incl. eroding)	Woodland	Pasture	Cultivated
A	Marshall	234.00	21.4	71.1	3.4	2.8	22.8
B	Marshall	110.35	19.7	24.6	15.9	38.8	17.7
C	Lafayette	83.29	11.8	14.7	27.4	33.6	24.3
D	Lafayette	185.14	9.2	14.1	12.7	47.6	25.6
E	Carroll	83.70	3.0	13.3	28.8	45.7	12.2
Average		139.30	13.0	27.6	23.6	33.7	20.5

comes sub-marginal and is abandoned or made into pasture. When attempts are made to improve the so-called permanent pastures such as by planting forage plants, overgrazing usually follows. Most abandoned lands are left to erode and to revert eventually to waste areas. Improper land use has probably caused more soil wastage in Mississippi than any other single factor.

2. *Methods of cultivation.* Methods of cultivation have improved but little since the first settlement took place. Contour plowing is generally practised but is usually so crudely done that it is not effective in preventing erosion even on gentle slopes. Agricultural engineers of the Mississippi Agricultural and Mechanical College have strongly advocated the terracing of all sloping lands that are cultivated. However, they advise against terracing slopes greater than 15 per cent as they consider the steeper lands suitable only for pastures or forest purposes. Despite these efforts toward bringing about better farming methods, terracing is rarely done and shallow plowing that barely scratches the surface is the general practice. Soil permeability is reduced by this type of cultivation, while run-off and soil movement are increased. Terracing and deep plowing are essential where sloping land is under cultivation throughout the region.

3. *One crop system.* Cotton and corn are staple crops in Mississippi and the cultivation of these crops exposes the soil year after year on the same field. Old stalks and similar material on the ground are usually burned rather than being plowed under. The soil tends to become deficient in organic matter, loses its absorptive capacity and then erodes more rapidly. The growing of legumes and winter cover crops and crop rotation in general is being advocated by agricultural authorities throughout the state and these practices would do much to build up the depleted soils and decrease erosion.

4. *The tenant farmer.* Probably 75 per cent of the farms in northern Mississippi are operated by negroes working on shares while the owners reside in town. The lack of interest that the owners display in their land is apalling, and the tenants care even less. Expenditures for land improvement seem out of the question, and fields too badly eroded to be productive are abandoned as a matter of course. Agriculture in this region will in all probability be carried on by tenant farmers for some time to come, which is an unfortunate situation, especially as it concerns erosion control.

5. *Fire.* The common practice throughout the South of annually burning woodlands, pastures, and waste lands, thereby exposing the soil to the direct action of rain and preventing the accumulation of organic material has no doubt been an important factor in increasing soil erosion in Mississippi. Only through education can this practice be stopped. The present campaigns against woods burning are building up favorable public reaction and should be continued with further emphasis placed upon the damaging effects of burning pastures and waste lands.

6. *Road drainage.* The water collected in roadside ditches is often turned onto unprotected soil without thought of serious consequences. Many of the

worst gullies might have been prevented if proper care in road drainage had been practised. Numerous instances have been observed where gullies thus formed have engulfed the original road and advanced onto adjoining lands or are held in check only by large expenditures for control work. Local boards of supervisors, the State Highway Department, and the Bureau of Public Roads should provide adequate means to handle the drainage along roads, thereby protecting their own interests as well as those of the farmer.

Instances are very infrequent where erosion has been controlled or partially checked either by natural circumstances or artificial means. Vegetation would in time establish itself naturally on the more favorable sites but man by his activities of clearing and burning seldom allows this process to go on unhindered. Attempts to control erosion by the planting of vegetation are, with few exceptions, limited to road embankments, which are usually protected by Bermuda grass.

A program of land reclamation was recently inaugurated by the Extension Forester in Mississippi, with the purpose of interesting farmers and landowners in controlling erosion on their property by planting black locust. Members of the Southern Forest Experiment Station staff engaged in erosion studies assisted at several of the demonstrations that were held and the progress of this work will be watched with much interest.

As previously inferred, the disastrous effects of erosion are not confined to the hill lands and any discussion of the problem would be incomplete unless mention is made of the silting of streams, the ruination of good bottomlands, and the killing of timber by the deposition of infertile material washed down from the uplands. Many of the streams and rivers of northern Mississippi, some of which were formerly navigable, are now filled with sand from bank to bank and even moderate rains cause them to overflow.

In northwestern Marshall County a drainage district was organized in 1925. A ditch 10 feet deep, 20 feet wide and 20 miles long was excavated in order to drain bottomlands valued at $50 per acre. By 1927, the ditch had filled with sand from gullied hill lands above. Spring floods of that year overflowed the ditch, deposited from three to six feet of sand on some of the best bottomlands and killed a stand of hardwood timber worth $50 per acre. The ditch was dredged out in February, 1930, to a depth of 13 feet but by the following June it had silted up until its average depth was but three feet. With another heavy storm, the events of 1927 will be repeated. The land owners will be paying off drainage bonds for years to come, with no profits from these expenditures, yet few of the land owners today realize that this silting has been caused by the gullied hills above.

Farther down the same watershed along the Coldwater River, a tract of fine bottomland hardwoods was being logged in the fall of 1930. Beautiful specimens of figured red gum scaling up to 5,000 board feet per tree were being cut. However, the number of dead trees in the stand was very pronounced. In-

Fig. 1

Fig. 2

Fig. 3

Fig 1.—Badly gullied hillside. The result of removing the protective cover. Irby Hurdle farm at Slayden, Marshall County, Miss.
Fig. 2.—Critical erosion in brown loam soil underlain by Wilcox formation. 1.5 miles east of Waterford, Marshall County, Miss.
Fig. 3.—Silt and sand deposited in ravine. An old break now from 300 to 400 feet across and a mile long. 3 miles east of Abbeville, Lafayette County, Miss.

quiry revealed the fact that from five to six feet of silt had been deposited on this area since 1920, and had reduced the stand from 30,000 to 20,000 board feet per acre, a very considerable loss to the owner. The source of the trouble could again be traced to the eroding hill lands.

The landowner is often economically unable to control erosion, especially the farmer whose good bottomland is ruined by material carried down and deposited from lands of other ownership above him. They stand in awe of such catastrophies and term them acts of God rather than of man.

The individual counties are unable to cope with the erosion problem. At the recent Mississippi Land Use Conference, it was also stated that the rural communities of Mississippi, with few exceptions, are receiving more money from the State Treasury than they are able to raise from abnormally high taxes on diminishing land values. The situation warrants the attention of the state and federal governments, for the reclamation of these eroding lands is of more than local concern.

Reforestation presents a basis for the solution of this problem. A tree cover, besides controlling erosion and regulating stream flow, would at the same time make the abandoned lands yield an economic return in the form of forest products. Preventing erosion in the uplands would also stop the losses from silting farther down the watersheds.

The Southern Forest Experiment Station through its erosion studies is obtaining information essential to the establishment of a vegetative cover on the eroding lands of Mississippi, which may again be made productive when protected by forests.

PRUNING IN YOUNG PLANTATIONS

By HENRY W. HICOCK

Connecticut Agricultural Experiment Station

In this article the author describes an experiment which was carried on with four groups of twelve trees each to determine to what extent the living crown of a tree could be reduced by pruning without seriously curtailing height growth. Thinning was based on the depth of the crown at various per cents of the total height of the trees.

IN THE FALL of 1924, an investigation was started in the Rainbow Plantations of the Connecticut Agricultural Experiment Station to determine to what extent the living crown of a tree could be reduced by pruning without curtailing height growth.

The experiment was conducted in pure red pine planted in 1920 with a spacing of 6 x 6 feet on a relatively poor but uniform site on a sandy outwash plain. The results, however, will probably be applicable to other coniferous species.

Four groups (parallel rows) of 12 trees each were selected, later referred to as I, II, III, and IV. The average heights of these groups at the end of the 1924 growing season were 43, 42, 39 and 41 inches, respectively, thus indicating that the development in the several groups had been quite similar.

In group I, the standard set was a crown whose depth would be maintained at 25 per cent of the total height of the tree. In group II, the crowns were maintained at 50 per cent of the total height, in group III 75 per cent, and in group IV at 100 per cent. Group IV thus served as an unpruned check. Each of the above groups consisted of a single row.

Every tree in the experiment was allotted a number. Annually, at the end of the growing season, the height of each tree was measured and the crown reduced by removing whorls of branches to as near the standard set for its particular group as possible. It was impossible to maintain every tree or even a group at the standard all the time, although the average depths of crown for the various groups were kept very close to the standards set during the six years that the experiment has been carried on, being actually 25, 50, 72 and 100 per cent respectively. Group I varied most widely, from 30 per cent in 1924 to 20 per cent in 1925, and thereafter between 23 and 26 per cent. Group IV retained branches to the ground through 1930. Figure 1 shows the height development of the groups in graphic form.

Based on the original heights, the group averages in 1930 showed increases of 154 per cent, 188 per cent, 295 per cent and 280 per cent respectively, the accretions being reasonably uniform from year to year through the 6-year period.

A more evenly graduated series of curves might have resulted had the basis for thinning been crown volume

rather than depth, since it is evident that with only 25 per cent of the depth, the crown volume may have been only about 10 per cent of that of an unpruned crown. On the other hand, considerably more computation would have been necessary both in the field and in the office and it would have been necessary to translate the data into terms of tree height before they could be readily used. The experiment probably does not show fully the effect of severe crown-pruning on the soil, as it would have if each group had been more extensive.

Conclusions

1. The pruning of live limbs in plantations prior to the time of the closing of the crowns can be done without serious effect, provided it is done conservatively. From the data presented it seems unwise to remove more than one-third of the living crown, otherwise too great curtailment of height growth will result and the trees will be weakened and subject to snowbreak and other injuries.

2. The operation can be performed

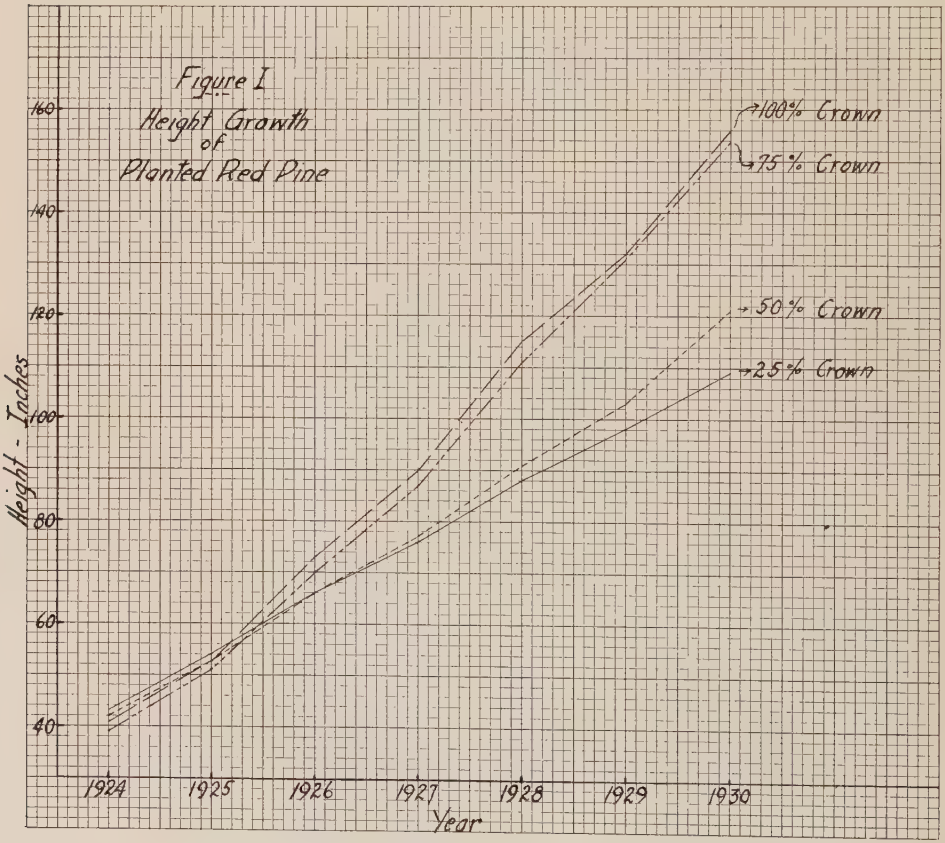

Fig. 1.—Height development of planted red pine pruned to varying crown lengths.

easily and quickly with a sharp knife or pruning shears. It will be necessary at this stage in the development of the stand to prune all the trees because it is practically impossible to select crop trees. This will, of course, result in some wasted effort because from two-thirds to three-fourths of these trees will later die or be removed in thinnings. On the other hand, pruning early and often will result in a smaller core of knotty wood, there will be less accumulated debris on the ground as a fire menace, wounds will heal more quickly and all necessary operations can be performed with greater ease than when pruning is delayed until the crowns have closed.

There was a time when some of the activities and occupations (of foresters) were regarded as rather outside the sphere of forestry. Even now the question is often agitated whether a graduate forester who is employed by a lumber company in work connected with the manufacture and distribution of products is still one of the elect and worthy of continued recognition as a forester. It is my impression that some of these men may soon be in a position, on account of their experience and contacts, to aid in developing industrial forestry on a large scale and setting forestry ahead more effectively than many other foresters who have been engaged in work more peculiarly connected with the growing of trees. I certainly hope that we shall not look askance at those trained foresters who at the moment are building roads, making maps, supervising accounting, or doing other work that might be performed by someone who does not possess the special knowledge of the science of forestry.

HENRY S. GRAVES,
Dean, Yale School of Forestry.

SOME RESULTS OF THINNING 27-YEAR OLD JACK PINE

By T. SCHANTZ-HANSEN

Forester in Charge, Cloquet Forest Experiment Station, University of Minnesota

The investigator in this instance found large-scale thinnings in young Jack pine stands economically unsatisfactory since the resulting product could not be marketed. Volume growth in itself was not stimulated sufficiently to justify thinning, however, since the growth was accumulated on fewer trees in the case of the thinned plots as compared to unthinned plots, there resulted individual trees of higher quality and more marketable sizes.

THE FAILURE of a 37-year old stand of jack pine, (*Pinus banksiana* Lambert) on the Cloquet Forest to respond to a thinning (2) brought home, forcibly, the fact that we actually know very little concerning the effect of thinning. Further investigation was therefore necessary not only to increase our knowledge of the effect of thinning this species, but also to solve a practical management problem on the Forest. A dense stand of 32-year-old jack pine occupies 250 acres, or 8.5 per cent of the forest area. This stand originated after a fire in 1894 and is unusually dense. The number of trees varies from twelve hundred to four thousand to the acre. The general appearance of this stand is shown in Figure 1. The density and uniform canopy of the stand make it an ideal one for experimental thinnings.

Procedure

Two thinning plots were established in this stand in 1925 when it was 27 years old. Plot 6, one-half acre in size, was heavily thinned; Plot 7, four-tenths of an acre in size, was lightly thinned. A one-quarter acre check plot was also laid out. A control strip 33 feet wide around each plot was given the same treatment as the plot. For convenience in marking, the plot was divided into one-chain-square units. The trees to be left were marked with white paint and later measured at breast height and numbered with zinc tags placed at five feet. The diameter breast high, total height and age of each tree removed were recorded.

The three plots were remeasured in the early spring of 1930. All diameters and heights of ten trees in each inch-diameter class were measured. This was sufficient to form a well-defined height-diameter curve.

Site Factors

The stand is growing on a light, deep sand. The ground cover consists of blueberry, wintergreen, sweet fern, trailing arbutus, honeysuckle, bracken fern, and other herbaceous plants such as strawberry, aster, false lily-of-the-valley, false Solomon's seal and fire weed. Underbrush such as hazel, alder and willow is almost absent, since the stand is so dense. The topography is flat to gently rolling. The water table is probably never more than from ten to fifteen feet below the surface and is

Fig. 1.—Unthinned stand. 30-year-old jack pine.

Fig. 2.—Jack pine thinning plot No. 6.

Fig. 3.—Student practice thinning in 30-year-old jack pine. Type of thinning on which the cost data was based.

often much closer. Normally the growing season extends from May 1 to August 31. The annual precipitation varies from 25 to 30 inches and for the growing season is about 14 inches. The mean temperature for the growing season is 55° F. Killing frosts may occur during any month of the year, but usually not later than June 15 or earlier than September 15. The winters are long and severe with heavy snows. Temperatures of —45° F. occur nearevery winter.

Site Classification

The average height of the dominant tree shows that this stand is in the 50-foot site index class. In all probability this classification is somewhat influenced by the density of stocking. It is believed, however, that the stunting effect of density would not change its site index classification. This site class corresponds to the average for jack pine in the Lake States.

Density of the Stand

The degree of stocking of each plot was determined by comparing the actual stocking with normal stocking as given in the normal tables[1] for jack pine. Before thinning there were 2,478 trees one inch in diameter and over per acre on Plot 6. This is 47 per cent more than in average normal stands. The actual stand basal area of 105 square feet, however, is 4 per cent less than average normal. More trees and less basal area than normal gives an average diameter six-tenths of an inch less than average normal.

Plot 7 before thinning averaged 2,230 per acre, or 32 per cent more than average normal, while the stand basal area was 6 per cent less. The average diameter was five-tenths of an inch less than normal.

Both of these plots, had they been among the data collected for the yield table, would have been considered normally stocked, both by number of trees and stand basal area. The large number of trees per acre, as compared with average normal, and their crowded appearance, gave every indication that the stand needed a thinning.

The check plot had 3,040 trees per acre, or 80 per cent more than average normal. The actual stand basal area was less than average normal by 13 per cent. The average diameter was one inch less. This plot would have been rejected as overstocked by number of trees although its stand basal area fell within the limits of normality. Without question it is too densely stocked and unfortunately more heavily overstocked than either of the thinning plots. Table 1 gives a summary of the stand data before and after thinning and the corresponding figures for average normal stands of the same age and for similar site qualities.

Degree of Thinning

The thinning in each case was from below, removing the suppressed, intermediate and most of the co-dominant

[1]The normal yield figures have been taken from an unpublished yield table based on site index classes which were used as the basis for the yield table based on three site index classes published in Wisconsin Research Bulletin No. 90, Yield of Jack Pine in the Lake States.

TABLE 1

DEGREE OF THINNING AND COMPARISON OF JACK PINE PLOTS WITH NORMAL STANDS

Plot No.	Age 1925	Diameter breast high			Total height		Number of trees per acre[1]					
		Original	Normal[1]	After thinning	Original	After thinning	Original	Normal	Percent above normal	Removed	Left	Percent removed
	Years	Inches			Feet		Number					
6	27	2.8	3.4	3.3	23	29	2,478	1,690	+47	1,710	768	69
7	27	2.9	3.4	3.4	23	29	2,230	1,690	+32	1,125	1,105	50
Check	27	2.4	3.4	---	23	---	3,040	1,690	+80			

Plot No.	Basal area per acre[1]						Volume per acre[1]					
	Original	Normal	Percent below normal	Removed	Left	Percent removed	Original	Normal	Percent below normal	Removed	Left	Percent removed
	Square feet			Square feet			Cubic feet			Cubic feet		
6	105	109	— 4	59	46	56	1,642	1,880	—13	916	726	56
7	103	109	— 6	59	69	33	1,704	1,880	— 9	636	1,067	37
Check	95	109	—13	---	---	---	1,642	1,880	—13			

[1]One inch and up. Volume includes stump, stem, top and bark.

TABLE 2

COMPARISON OF THE STAND DATA AT THE BEGINNING AND END OF THE FIVE-YEAR GROWTH PERIOD

Plot No.	Age 1925	No. of trees per acre		Mortality per acre		Basal area per acre		D. b. h.		Volume[2] per acre		Growth-per acre		
		1925	1930	No. trees	Volume	1925	1930	1925	1930	1925	1930	Periodic Volume	Periodic Percent	Periodic Annual
	Years			*Cubic feet*		*Square feet*		*Inches*		*Cubic feet*		*Cubic feet*		*Cubic feet*
6	27	768	760	8	7	46	69	3.3	4.1	725	1,128	403	56	81
7	27	1,105	1,097	8	7	69	87	3.4	3.8	1,066	1,348	282	26	56
Check	27	3,048	2,496	552	121	95	116	2.4	2.9	1,497	1,910	413	28	83

[2]Total cubic volume of stem wood with bark.

trees. Uniformly spaced, thrifty, well-crowned dominant trees were left. On Plot 6, an effort was made to thin to an 8 by 8 spacing, or about 700 trees per acre. This is about 10 per cent more than the normal number of trees per acre 4 inches in diameter and over. On Plot 7, an attempt was made to thin to a 6 by 6 spacing, or approximately 1,200 trees per acre. This number of trees is about double the normal number of trees 4 inches and over in diameter. In each instance, the thinning apparently provided considerable additional growing space for each tree.

The thinning removed 69 per cent of the trees and 56 per cent of the cubic volume from Plot 6. This degree of thinning left 768 trees per acre, or 45 per cent of the normal number of trees one inch and over in diameter. By removing most of the trees in the smallest diameter classes, the average diameter of the trees left averaged five-tenths of an inch more and the average height six feet more than the average diameter and height before thinning. The stand basal area was reduced to 42 per cent of the basal area of average normal stands. After thinning, this stand appeared to have been very heavily thinned. Figure 2.

From Plot 7, 50 per cent of the trees and 37 per cent of the cubic volume were removed by the thinning. This left approximately 65 per cent of the average normal number of trees, or 1,105 trees per acre. The average diameter after thinning was five-tenths more and the average height six feet more than before thinning. From all appearances the thinning provided each tree with considerable additional growing space.

Results of Thinning

The growth in volume on Plot 6 is 56 cubic feet for every 100 feet of wood capital left standing. The total growth per acre for the five-year period is 403 cubic feet. This is equal to a periodic annual rate of 81 cubic feet or 85 per cent of average normal. This plot now has a basal area of 69 square feet per acre, which is 60 per cent of average norml, while the number of trees is 56 per cent of average normal. Eight trees having a volume of 7 cubic feet were lost, due to natural causes, during the five-year period. If there be no serious loss, this plot should have the normal number of trees when it is 45 years old. The average diameters increased from 3.3 to 4.1 inches, which is two-tenths of an inch above average normal.

For every 100 cubic feet of wood capital left on Plot 7, 26 cubic feet were produced. The total growth in volume for the five-year period is 282 cubic feet, or the equivalent of an annual rate of 56 cubic feet per acre. This annual rate is 58 per cent of average normal. The plot now has a basal area of 87 square feet per acre, which is 76 per cent of average normal as its present age, while the number of trees is 80 per cent of average normal. Eight trees, or 7 cubic feet per acre, were lost during the five-year period. If there be no further loss, Plot 7 should have almost the normal number of trees at 35 years. The average diameter increased from 3.4 to 3.8 inches, or to within one-tenth of an inch of average normal.

The check plot showed a volume increase of 28 cubic feet per 100 cubic feet of wood capital left. The periodic annual increment was 83 cubic feet per acre, or 86 per cent of normal. The average diameter increased from 2.4 inches to 2.9 inches, or to within nine-tenths of normal. This plot has now a basal area of 116 square feet per acre, which is 2 per cent above the average normal. The number of trees is 83 per cent above the average normal. A loss of 552 trees per acre, or a volume loss of 121 cubic feet occurred. If the same rate of loss occurs this plot should have about the normal number of trees at 50 years.

The heavily thinned plot (No. 6) showed the largest percentage increase in volume. The growth in volume on Plot 6 is 30 per cent greater than Plot 7 and 28 per cent greater than the check plot. Percentage increase in volume is, however, not a fair basis of comparison, since they are all figured on a different basic volume. A comparison of the cubic foot volume increase shows that the check plot and Plot 6 had approximately the same volume increase, while the volume increase on Plot 7 was 120 cubic feet less than the other two. Although a considerable number of trees were removed from Plot 7, there was no marked increase in the rate of growth. Therefore, the volume increase would naturally be less than the check plot because of the small number of trees left. The explanation of the smaller volume of increase in this plot may be due to the fact that the stand may not have been opened up sufficiently to greatly stimulate the growth. Table II gives the comparison of the stand data at the beginning and end of the five-year period.

The volume increase taken alone does not show much advantage in thinning. In the thinned plot, however, the volume increase was produced by only 760 trees, while in the check plot it was produced by over 2,496 trees. The chief objects of thinning are to increase the rate of growth, shorten the rotation, and to improve the quality of the product. The average diameter for the check plot is 2.9 inches, while the average diameter for Plot 6 is 4.1 inches. By concentrating the growth on a few selected trees, the product that may be cut from Plot 6 is not only superior in quality but also in size.

Jack pine is an intolerant tree and is therefore slow to develop new crown volume and to adjust itself to new conditions. The heavily thinned plot may show a more rapid rate of growth in the next five years as compared with the check plot. Five years is, of course, too short a period in which to determine the value of thinning. It can simply serve as an indicator.

From an economic standpoint, a large scale thinning in stands of jack pine such as this is not feasible at the present time. Since the establishment of these experimental thinnings, thirty acres of this age class have been thinned by forestry students. Only a portion of the stand was measured, but all of the trees to be left were marked. A very creditable thinning resulted. The trees removed were cut in random lengths and piled at a point convenient for removal. The slash was lopped and scattered. On the basis of this work it was determined that 48 to 240 one-man

hours were required to complete an acre. Based on the thirty acres thinned, the average is about 64 one-man hours per acre. At the current wage this means an average expenditure of $22.40 per acre. The product was usable, but not marketable. The general appearance of a thinning plot on which the cost data are based is shown in Figure 3.

In a somewhat similar stand of jack pine on the Chippewa National Forest, Averell (1) found that from 10.5 to 35 man hours were required to thin an acre. "At the current wage of 37.5 per hour, this meant an expenditure of $4.00 to $13.00 per acre". This wide difference in cost is doubtless explained by the following statement, quoted from his article: "The products of thinning could not be sold. It even required additional expenditure for piling and burning the brush". Evidently Averell's figures include in the cost of thinning only the felling of the trees, while the Cloquet costs include the piling of the product at a convenient point and the disposal of the slash. In one case a complete job; in the other case a partial job.

Even using Averell's more favorable cost figures, large scale thinnings in young jack pine stands are not economically feasible at this time. But if the area in question were a farmer's woodlot where the resulting product could be utilized at home the conditions certainly would warrant the practice.

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THE EUROPEAN PINE SHOOT MOTH IN RED PINE PLANTATIONS

By ROGER B. FRIEND

Instructor in Forest Entomology, Yale School of Forestry and Assistant Entomologist, Connecticut Agricultural Experiment Station

That the American forester must also be a good entomologist is indicated in this article. As soon as he has removed one obstacle to reforestation a new one appears. In this instance the author discusses the prospect of serious loss in red pine plantations due to an insect immigrant whose work seriously injures the terminal buds and stunts growth of many species of the yellow pine group. He gives some details on life history, habits, hosts and methods of control. Inasmuch as the European shoot moth will attack also western yellow pine, its spread is of national concern. Foresters, therefore, should acquaint themselves with it early to be better able to combat it.

THE EUROPEAN pine shoot moth, *Rhyacionia buoliana* Schiff., was first discovered in the United States on Long Island, New York, in 1914, and since then it has been found in many states in the eastern part of the country and also in Canada. This insect has seriously injured some of the red pine plantations in Connecticut during the past ten years, and with the increase in plantations of red pine it may become as serious an enemy of this tree as the weevil is of white pine. At present it appears to be the most serious potential enemy of red pines in New England.

Both adult and larval stages of this insects are fairly easily discovered in infested areas. The adult moth has a wing spread of about two centimeters, and the fore-wings are reddish brown in color with two silvery bands near the tip. The hind-wings and body are greyish brown in color with two silvery bands near the tip. The hind-wings and body are grayish. The adults may be found during the day resting on the foliage, but about dusk they may easily be seen fluttering around the trees. The larva is dark brown in color and when fully grown measures slightly under two centimeters in length. The head and thoracic shield are black. The larvae occur in the buds from early in July until late in the following May in Connecticut.

In Europe, where the insect has long been known in the pine forests, it causes more or less serious injury to young trees every year in some localities. Although the Scotch pine is the principal host, it is found on other species, sometimes heavily infesting them, and occurs throughout the continent and on the British Isles, from Sweden to southern Europe and from Great Britain to central Siberia and Korea. The host plants include *Pinus sylvestris, P. laricio, P. pinaster, P. austriaca, P. montana* var. *mughus, P. strobus, P. resinosa, P. sabiniana P. ponderosa, P. taeda, P. contorta, P. banksiana* and *P. muricata,* not all of which are important forest trees and many of which have been imported from America. The Scotch pine appears to be the usual native host. The injury is usually confined to the

younger trees under 30 feet in height, and nurseries and young plantations suffer most. Older trees are sometimes infested, however, and from these the insect readily spreads into younger growth. It is interesting to note that Rodzianko (1916) reports an infestation of the male inflorescences of tall trees in the Baltic Provinces, near Riga.

The life history of the shoot moth is well known in Europe. In central Europe the adults fly from the latter part of June until the first part of August, the flight reaching a peak in July. The female lays its eggs singly on the twigs near the terminal buds, both leader and lateral branches being affected. The larva bores into a bud and feeds until cold weather, hibernating then in its burrow. In the spring feeding is resumed and the larva moves from one bud to another, destroying each in turn until the entire cluster may be killed. It also bores a short distance into the twig. When mature the larva pupates in its burrow, and after three weeks the adult moth emerges, leaving the cast pupal skin projecting out of the entrance. Eggs may be laid as early as the last of June. There is thus but one generation a year. According to Rodzianko (1913) the larva pupates in the Kiev region the last of June, and the same writer (1916) reports the eggs hatching the last half of the summer in the Baltic provinces, a regional variation which would be expected. At Verrières, in France, de Vilmorin (1917) states that pupation occurs during the first half of June and the adults fly during the latter part of June and the first part of July. Ryle (1928) in England gives the date of pupal period as June, and of the period of adult flight as June and July. The seasonal occurrence of the stages in Europe are interesting in that the life cycle begins very little later than in the United States and also in that nowhere does more than one generation occur annually. There is a variety of this species, *R. buoliana* var. *thurificana* Led., which is found in Palestine, on the Island of Cyprus, and in southern Spain and has two generations a year. A recent report of its injury to *Pinus pinea* in Palestine is given by Bodenheimer (1927).

The principal injury caused by the insect is the distortion of the stem due to the killing of the terminal buds. This is somewhat similar to that caused by the weevil in white pine but is usually more pronounced and is given various names by European entomologists, among which "bayonet tip" seems appropriate. The young trees are also severely stunted in growth. The result is often trees of much lessened value as timber, sometimes being so crooked as to be useless for boards. As previously mentioned, after the trees attain a growth of about thirty feet, they do not usually suffer any appreciable injury, although they may be slightly infested.

The control measures advocated in Europe consist of pruning and burning the infested tips while the larvae are contained therein. The insect tends to remain in one rather circumscribed locality and to reinfest the trees from year to year, a fact which renders control more easy. How extensively this is sometimes practiced may be estimated from a report of an operation in

a small plantation in the Tambov region in Russia where, in 1915, 216,000 larvae were collected and destroyed at a cost of about $1.50 per acre. Parasites of this insect are abundant in Europe, chiefly Ichneumonidae, and often appear to effect a fair degree of natural balance. They cannot be relied upon to protect young plantations, however. Birds also feed on the larvae to some extent.

The shoot moth apparently prefers certain species of pines and its injuries are more serious on pines growing on certain types of soil. According to Ryle (1928) the Corsican pine (*Pinus laricio*), although sometimes badly attacked, often remains uninjured even when close to infested Scotch pine. Pines growing on poor sites are more likely to be severely injured than those growing on better soil, and Munro (1920) states that a severe infestation may be an indication of poor soil. Both vigorous and slowly growing pines are, however, subject to attack.

In the United States the shoot moth was first reported by Busck (1914), who found the insect on some young pines on Long Island in 1914. Busck later (1915) published a summary of information regarding the insect in Europe and the United States. Since then additional reports have appeared concerning the insect in North America, and it has been found in Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, West Virginia, Florida, Ohio, Illinois, Michigan, Nova Scotia, Ontario, and British Columbia. In many of these states and provinces it was first found on small trees imported from Europe. In most localities the infestation has appeared only in nurseries or ornamental plantings, but in Connecticut it has become established in some small forest plantings of red pine.

The principal host plants in the United States appear to be the imported and ornamental species. Among trees used in forest plantings the Scotch and red pines appear most affected. In Florida the infestation found in 1929 was on long-leaf pine in the immature cones (Coville, 1929). The American pines imported into Europe are attacked there when young. In Connecticut the infestation in forest plantations appears on red and Scotch pines, but not on white, although this last tree is subject to injury in Europe and has been found infested in Ontario. The reports from Europe of infestations on these trees and on *Pinus ponderosa, P. taeda, P. banksiana,* and *P. contorta* render great the possibilities of the insect becoming seriously injurious in America. In Connecticut the red pine plantations which have become infested show the typical distortions of the trunk and stunting of the growth (Britton 1927). At Easton the pines are fifteen to twenty feet high and the tips of the laterals and the leaders have shown no growth during the last few years. As the tip buds are killed adventitious buds are produced immediately under them, and these in turn are killed. The result is a dense bushy tip which increases in size from season to season. A large number of trees were in such hopeless condition at this plantation last year that they were cut and burned. The Scotch pine interplanted among the red was not nearly so severely injured, and

the jack pine in the same locality was not infested.

On the Eli Whitney Forest at New Haven there are two small plantations of red pine, one slightly less than an acre in extent and the other about twice as large, both of which have been infested for at least four years. The smaller plantation is on a gravel bank where soil conditions are poor and the natural growth of the trees slow. The trees are two to three feet high, and between 5 and 100 per cent of the branches in the upper two whorls are so badly infested that they have shown little if any growth the last two years. The tips of the branches are large and bushy, and the trees are badly dwarfed and malformed. Unless the infestation can be eradicated the plantation will be useless. In the larger of the two plantations the trees were from six to 10 feet high before the infestation became severe, but over 90 per cent are now adding no new height growth and many of the leaders are dead. The usual bunching of the tips is developing. In a Scotch pine plantation covering several acres between the two small red pine plantations the infestation is much lighter. The trees are about 20 feet high and only a few are injured to such an extent that the typical "bayonet-tip" has developed. The white pine interplanted with the Scotch has not been attacked.

The life cycle and habits of the insect are now being investigated, for little is known about the biology of the insect in America. A few observations have been made which bear on its importance to forestry. It appears that here, as in Europe, the insect is single-brooded, and the adults fly during June, pupation occurring the last of May and the first of June. The adults may be easily seen at dusk on warm quiet days fluttering around the trees. During the daylight hours they rest on the foliage and branches. The eggs are laid on the buds and on the twig close to the buds. By the end of the first week in July the young larvae are boring into the buds. The larvae feed all summer and move from bud to bud, often boring half an inch or more into the twig, and their presence may be easily detected by the pitch on the infested buds and by the appearance of dead needles at the tips of the branches. Often the larvae will eat the bark of the new growth. Hibernation occurs in the larval stage. The infestation does not spread very rapidly, the trees in one restricted area being reinfested year after year. The adults hover in the air around the trees and fly only a short distance. At Easton the area of infested red pine is sharply demarcated from the uninfested surrounding trees, and in the infested Scotch pine plantation at New Haven the injured trees are not uniformly distributed.

The control of this insect in forest plantings offers some difficulties once the pest is firmly established, but an inspection of the trees during the summer or later when dead needles and conspicuous pitch accumulations on the buds make detection easy should make it a fairly simple matter to keep the insect down so that no great amount of injury occurs. The relatively slow spread of the insect by adult flight makes the system more feasible. The infested tips should be cut off and

burned. If heavily infested trees are found, they too should be cut and burned. In Massachusetts the insect has been practically eliminated from nurseries by careful inspection. Once eradicated, reinfestation would probably be slow.

Smith, Fisher, and Guyton (1930) secured promising results from spraying for the control of a native species, *Rhyacionia frustrana* Comstock in Pennsylvania. In view of these results we have attempted to reduce the infestation in a small plantation by spraying. Two commercial brands of light mineral oils were used at two per cent strength and also a combination of nicotine sulfate (40 per cent nicotine) at a dilution of one to four hundred in a one-half of one per cent Penetrol solution. Two applications were made, ten days apart, the latter part of June. The number of infested tops was reduced from between 75 and 90 per cent to 38 per cent by the Penetrol-nicotine combination. The oils were less efficient, and in view of the possibility of foliage injury, their extensive use is of questionable merit, particularly at this season of the year. The purpose of spraying was primarily to kill the eggs, but a large proportion of the adults were also killed. A third application ten days later would probably give better results. This spraying procedure is both too expensive and too impracticable for use on large areas.

It appears from our observations to date that an annual inspection of young red pine plantations accompanied by pruning and destroying the infested tips is the most feasible method of keeping the insect out. The greatest danger of introducing the insect into a region lies in importing young infested trees. We have found five-year-old red pine seedlings attacked. Although the importation of young pines from Europe has been forbidden by Federal quarantine for several years, the insect is now well established in some parts of the United States and Canada. If red pines are planted near stands of Scotch pine, even though the latter trees are over 20 to 30 feet in height, there is considerable risk of the insect spreading to the former unless a very careful examination of the Scotch pine shows these trees to be free of infestation. Tall Scotch pines may harbor a light infestation which is somewhat difficult to detect. The same precautions apply to plantings of red pine in areas where there are other European species or such ornamentals as mugho pine in the vicinity. According to reports from Europe trees growing on poor soil, other things being equal, suffer more than trees on better sites.

There is some promise of native parasites attacking the insect and aiding in keeping it down. Sheppard (1930) reports the presence of native parasites in Ontario, and Busck (1915) states that some parasitized larvae have been found in the United States. There are many parasites of our native species of *Rhyacionia* some of which may attack *R. buoliana.* It should be remembered, however, that in Europe this insect is very injurious in spite of the presence of parasites. Busck mentions 14 Ichneumonidae and one Tachinid as parasites in Europe, and Smits van Burgst (1919) reared 17 Hymenoptera from this insect in Holland where it is, nevertheless, a pest.

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FEEDING HABITS AND FORAGE REQUIREMENTS OF ROCKY MOUNTAIN MULE DEER IN THE SIERRA NEVADA MOUNTAINS

By C. S. ROBINSON

Technical Assistant, U. S. Forest Service

The author reports his observations of the habits of deer in seeking food and of their forage preferences. He considers it as important to assure deer adequate natural supplies of feed as the passage of protective laws, and that game refuges cannot be selected intelligently unless their resources for feed, water, shelter, and protection against enemies are satisfactory.

THE FOOD SUPPLY of the native deer of California is as great a factor in their conservation as are any additional laws added to the statutes by the state. If we are to promote plans for the preservation and increase of deer in order to take care of the constant demand made by hunters and others, then the question of the character and abundance of their food supply becomes one of equal importance to their future welfare as any other problem affecting their conservation. We have sound principles of constructive development of wood, water, forage and watershed, and must take up the question of game along the same lines.

The necessity of maintaining a proper balance between use by domestic stock and deer feeding on the same range is one of the essentials of good range management. Certain grazing allotments and game refuges within national forests, and foothill range of the large interior valleys of California used during winter and spring, have already been reported as showing marked signs of competition for feed.

It is not improbable that such conflicts in use will continue to occur. Protected areas in forests and parks where the rapidly increasing deer may be forced to move further afield, due to a scarcity of feed, or the demands of recreational use, are now being brought to our attention, and the presence of numbers of deer within a certain area cannot be taken as ample evidence that no scarcity exists either in animals or forage. Changes in vegetative cover brought about by repeated fires can cause starvation conditions on an area that once supported large numbers of grazing animals; and migration can often be traced to a definite shortage of seasonal feed.

Preference for certain plants over others by both game and domestic animals is a well-known fact, and in order to arrive at a proper carrying capacity of a range, a reconnaissance (stock-taking) of the forage resources of the entire area is made to determine chiefly (1) the class of stock to which it is best suited and (2) the character, abundance and value of the forage cover in terms of density or number, and the percent-

age of palatable plants accessible to the various classes of livestock. Recognition is taken of all the main factors affecting present and prospective grazing management on the area, these being considered thoroughly in the field, along with their relation to the protection of timber, watershed and forage. Such a procedure is necessary to insure stability of operation and it is upon the figures and conclusions so obtained that stock are now admitted to graze on range lands within the national forests.

It would seem advisable that any investigative work as to the requirements of deer found within the state, or within a certain forest or game district, should be carried out along similar lines. Thorough knowledge as to the kinds of plants used by deer as forage is as essential in any game management, or conservation plans, as it is in dealing with the problems of handling sheep and cattle on the range. The gathering of the data relative to the natural preference of deer for certain plants is however a much more difficult problem, due to the habits of the animals themselves. Studies made in areas where they are familiar with mankind, as in some of our national parks and game refuges, undoubtedly give good results, but this would be better suited, perhaps, to a local condition and could not be applied to the subject as a whole. A study to be entirely satisfactory should cover as wide a range as possible supplemented by months of close observation and scrutiny by the examiner of the deer in their native environment, and the longer this period could be, the more complete the results.

Feeding Habits

Deer feed little during the day time and rarely during the heat of the day. They appear to feed in early morning, late afternoon, twilight and on at intervals through the night to dawn. Nights of full moon are especially attractive as a time for feeding and it is no uncommon sight to see several small bands contentedly browsing, though ever watchful and listening for the least sign or noise.

The variety in chosen feeding grounds offers an interesting study. Sheltered areas seem to be preferred. Deer, like most wild animals, apparently dislike strong winds and in the Sequoia National Forest it was most unusual to see any number of deer feeding in areas that are exposed to the full sweep of wind. This was particularly noticeable where, during the day and often throughout the night, strong winds from the deserts play on the more exposed slopes and ridges of the South Fork of the Kern River watershed, Scodie, Piute and Breckenridge Mountains. Their aversion to working through wet brush following rainstorms and their avoidance of stormy exposed places remind one of the habits of the common rabbit. Indeed, in stalking either rabbits or deer, the practice of advancing only when they are actually feeding, remaining motionless when they look up, has often brought me within a favorable distance for observations.

Favorite feeding grounds during the spring in the Sequoia National Forest appear to be the long, low ridges extending down from the timber zone to where the oak thickets and choicest

browse are found. Where the ridges flatten out at lower elevations, seemed to be especially favored. Here the birch leaf mahogany (*Cercocarpus betuloides*) was very closely cropped and numerous trails led off into the oak thickets. The dense growths of shin oak (*Quercus brewerii*) in State Game Refuge 1-M on Breckenridge Mountain, Sequoia National Forest, show constant use. The deer have many small trails made in their search for acorns, and good utilization of the dried oak leaves was found on the ground at the time of examination, May 1, 1927. The same choice of feeding grounds holds good for the western slopes of the San Joaquin and Sacramento Valleys.

In the Sequoia National Park, south and southwest slopes seemed to be favored during winter and spring, and where the roads wind through the brush-grasslands and open park-like types below timber line, the deer are more numerous than in more secluded areas found on the north slopes where the brush is thickest and the forage less mature. This preference for southern slopes is most marked in sheep grazing; the south slopes of some of the sheep allotments on the Lassen and Plumas national forests may show signs of overgrazing; while the northern aspects are under-utilized. Generally speaking, however, deer and sheep do not mix; therefore, little use by deer of areas grazed by bands of sheep may be expected because of the similarity in choice of forage.

Forage Preferences

Certainly deer are mindful of a wide variety in food and their preference may be noted throughout the seasons of the year. This seasonal use was very noticeable during the spring and early summer of 1927. On the Flatiron Plateau, in June, on the Sequoia National Forest, at an elevation of 7,000 feet, I found an abundance of bitter brush (*Purshia tridentata*), well known to be a choice browse, that showed but very slight utilization by deer, yet there was ample evidence of their numbers. Where small moist places offered what one would imagine to be inviting fare, tender grasses and clovers, no sign of utilization was found. Yet upon the adjacent rocky, dry hillsides, the droppings were thick and the shrubs showed considerable usage. Later in the fall the hillsides were, to judge by the absence of tracks, neglected and the plateau in turn was well utilized.

Moving from place to place deer apparently seek out those plants most relished, and where they graze in areas inaccessible to domestic stock this habit of picking and choosing is quite noticeable. Again this matter of preference for certain plants and their seasonal use undoubtedly affects migration, instances being known of definite movements away from a range composed of plants believed to be unpalatable, to one well stocked with certain species readily taken by deer. This fact must be taken into consideration when attempting an explanation of a definite migration from, or to, a certain area during a time of year when the climatic conditions could not be held responsible for the movement.

Any list of forage plants that is made up for deer is by no means complete

and is but a tentative one which should be constantly checked and added to periodically. Their taste is extraordinary and equal to that of goats in variety. Small plantations recently established on the Lassen National Forest, planted to western yellow pine in 1928 with 2-year old seedlings, showed a 25 per cent loss due to being eaten off by deer. As pets they will devour almost any vegetable used by humans. Mushrooms, mistletoe and mosses are readily eaten. The composition of vegetation on range best suited to the requirements of deer on the forests of the Sierra Nevada region would seem, from personal observation, to be composed of approximately 60 per cent browse, 25 per cent weeds, and 15 per cent grasses and grass-like plants. Best summer range, based upon forage observations and estimates was found between elevations of 4,500 feet and 8,500 feet. Winter range should have well-defined areas where there is an abundance of browse forage of medium palatability, such as the various species of oaks that thickly cover the lower slopes of the Sequoia, Stanislaus, San Jacinto and Santa Barbara national forests, and the abundance of buck brush (*Ceanothus cuneatus*) and oak found on the western side of the Lassen. This, and the presence of large areas protected from strong winds, together with the absence of deep snow, seem in general to afford good winter quarters for the deer on the west slopes of the Sierra Nevada range.

While grasses and grass-like plants are cropped throughout the seasons of the year, the dried portions of grass forage do not appear to be readily eaten during winter as one would be led to believe. In March, 1927, on the Nicholl Peak range, in the Sequoia National Forest, it was surprising to note the untouched clumps of dried grasses. Again, on the Breckenridge Mountain Game Refuge, during February, where feed was scarce on the upper slopes, patches of dried grasses showed in the browse types (oak and birchleaf mahogany) and it was seldom that any utilization had been effected. Where the habitat of the deer includes large areas of distinct grassland formation to the exclusion of browse and weed species, possibly a higher percentage could be given.

Examination of winter range adjacent to the timber line on the western and eastern slopes of the Lassen in 1929-30 showed ample evidence where the snow had been pawed away to reach the squaw carpet (*Ceanothus prostratus*) yet clumps of dried bunch grasses could be seen close by without disturbing the snow. In the Sequoia National Park in April and May, 1928, close examination failed to show where melicas large bromes, and poas had been eaten at all. Small wet meadow sedges and rushes show good usage, throughout the summer, however, and mountain meadows are certainly to be considered as feeding grounds and have a distinct place in the deer's bill of fare.

I am inclined to dismiss the grasses as "general feed" used chiefly during spring and where suitable browse feed is scarce. In the Sequoia National Park, where opportunities enable one to study deer at close range, the majority of cases proved that on annual-grass types during April and May the deer chose

plants growing in close association with the annual grasses rather than the bromes, fescues, and hordeums. Alfilaria was picked out repeatedly, the deer seeking this plant most noticeably, and what was at first thought to be annual grasses being eaten, proved to be alfilaria. The clovers were eaten always in preference to grasses. It was also a significant fact that the oaks, of which there are a profusion at Hospital Rock, were trimmed up to a height where deer had to rear up on hind legs to reach the foliage, and elderberry and birchleaf mahogany bushes were eaten to bare stumps and branches. Live-oak sprouts from stumps were eaten, and this in an area where grasses were most abundant. A similar condition exists in the vicinity of the meadows at higher elevations near the hotel and big tree groves, where such shrubs as red bud (*Cercis occidentalis*), elderberry (*Sambucus glauca*) are severely damaged and the willows show close utilization; yet the meadows are knee-deep in grasses and sedges. On the Lassen National Forest in 1928, at Clover Meadows, I tracked a deer across an excellent fenced meadow of timothy and native grasses to where several patches of mule's ears (*Wyethia mollis*) and sour dock (*Rume sp.*) were growing in a moist spot in the meadow. These had been eaten down to the coarse stalks, yet ripe and tender grasses on all sides were untouched. Service berry and elderberry growing outside the meadow area were very closely trimmed and small conifers showed occasional use.

The similarity of deer to sheep and goats in preferring browse and weeds to grasses is noticeable over large areas, but the manner of eating browse species differs somewhat; the deer taking twigs of shrubs and small trees in a sidelong or diagonal jerky movement of the jaws, leaving many jagged and partially skinned portions, as against the more or less straight cropping by sheep. This was very evident in studying the conditions in the Sequoia National Park and in Game Refuge 1-M on the Sequoia National Forest, where damage to white fir reproduction had occurred and forage species were noticeably scarce. The manzanita bushes had been eaten, which is also frequently the case in the large-timber types in the Lassen National Forest. The preference seemed to be for the branches close to the ground. Both leaf and petiole were taken and the dragging of leaves off the boughs gave the bushes a noticeably ragged appearance. Logged-over areas on the Lassen where sweet birch (*Ceanothus integerrimus*) is a dominant shrub, show consistent use. Manzanita (*Arctostaphylos patula*) was untouched, and leads one to conclude that this shrub is eaten heavily only when palatable species are rare. Low shrubs such as snow brush (*Ceanothus cordulatus*) and *Ceanothus pinetorum*, exhibit a marked flattened top when closely grazed by deer. Often one may find definite circles of tracks around isolated bushes, where the deer have walked round and round nipping off the tender ends of the twigs. Their method of biting off the heads of the large Sierra thistle (*Cirsium californicum*) is certainly distinctive, and their ability to crop sedges and grasses more closely than cattle is often responsible for

their appearance in mountain meadows closely grazed by live stock.

Deer trails are narrower than cow trails, and a well defined deer trail usually ends where good browse begins. After the Mill Creek fire of 1928 on the Lassen National Forest, I passed through the burn in September, 1929. Coming up and out of the South Fork of Antelope Creek, I was struck by the number of new trails made that year by the deer. Straight, and at a convenient grade, they crossed and re-crossed the Forest Service trail at various angles. Rarely did they use our trail in their passage from the creek to the plateau above where the tender new shoots of oaks and browse species followed the fire. When the feed is more abundant the place will be a veritable network of trails which will in all probability be constantly changed as the feed situation demands.

Habits Related to Feeding

There is a possibility that deer when left to their own devices abandon certain trails after a definite season of use. On Goat Mountain in 1927, on the Sequoia National Forest, I examined carefully for several days some old trails leading to a small "stringer meadow" that showed no apparent use, yet deer fed regularly around the meadow and I discovered several new and well-defined trails that had been established but recently. This is a common habit in wild life and is a well-known trait of the large hare of the Eastern States and Europe; poachers setting snares invariably determine first the age of the "run" before putting up a noose. Also, it would seem feasible that in order to lessen the risk of surprise attacks from predatory animals a change in route would be advisable, for deer, while inclined to be curious, are wary creatures, acutely sensitive to all signs of danger from their natural enemies.

There is an association between places suitable for bedding-down and places suitable for feeding grounds. In the King's Canyon country on the Sequoia National Forest during August, while passing through isolated patches of good forage, in an area closed to grazing, one would almost invariably disturb a solitary deer, usually a buck, from its bed in the dense brush thickets close by. In the Sequoia National Park, small knolls and rounded ridges offering an interrupted view on all sides and where nothing can come near unobserved, appear to be in demand. It is no unusual sight to see one deer rouse another from its bed by striking it with the front foot and then to deliberately lie down in the chosen place.

Watering time appears to be in the evening before beginning to feed and at early morning. Along the Kern River on the Sequoia National Forest in August 1926 and 1927, north of Fairview, where steep slopes come to the water's edge, does and fawns appeared regularly a little before sundown to drink and then returned to the upper slopes to feed. This was also very noticeable along Rice Creek on the Lassen National Forest during the summer of 1928. Like sheep, their demand for water varies extensively with the quality of the feed. On the Uinta National Forest in Utah, where the herbage was more succulent, watering but once

in twenty-eight hours appeared to be sufficient during the summer months.

The use of salt is one of the best means we have in controlling the movements of stock upon the range, and salt has a similarly important place in management plans for game control. Salt is eagerly sought, especially during spring and early summer, by deer. Natural licks show constant use and the stockman, who salts frequently for his stock, finds a ready customer also in the deer. Where cattle are called for salting, stories have been told of the deer, especially does, shyly following behind the cattle, later moving up to the salt log when an opportunity arrived. In the Sequoia National Park at Hospital Rock, blocks of salt put out for the deer show constant use and salt is provided throughout the year.

Factors to be Considered in Selecting Game Refuges

It is advisable that careful consideration of the factors determining its suitability be made in selecting any area to be set aside for use as a game refuge. Because a section of country is unsuited as range for domestic live stock on account of its inaccessibility or has a wild and rugged appearance, it does not necessarily follow that it would be ideal for use as a game refuge. Abundant forage, water and sheltered feeding grounds must be found, where in the winter the snow does not fully cover the available feed, and where protection from driving cold winds may be found. Suitable slopes and aspects are essential, and at as great a difference in elevation as is possible. The presence of numbers of predatory animals causing great destruction among deer, especially fawns, must be taken into account and a means of their eradication provided. These are some of the necessities for the ideal refuge and cannot always be found in waste or inaccessible areas of the Sierra Nevada Mountains.

A list of plants (to be published later) covers 78 species of browse, 56 weeds, 23 grasses, and 5 genera of grass-like plants, with value ratings and economic notes has been worked up. Only those plants known to have been actually eaten by deer are included; others believed to be palatable were omitted because of lack of evidence or direct information. Information has been gathered from all sources, and observations extend over a period of years. Some small knowledge was gained during 1912-1916 while the author was living in the southern part of California; again opportunities arose while doing grazing reconnaissance work on the Uinta National Forest in Utah in 1925 and on the Stanislaus National Forest in 1926. Short studies have been made in the Sequoia National Park, but the bulk of the notes taken and observations made were done while making an extensive range reconnaissance in the Sequoia National Forest during 1926-1927, and on the Lassen National Forest in 1928-1929. The range in elevation, of life-zones, reaches from the Upper Sonoran to the Hudsonian, a variation of from 2,000 to 9,000 feet.

Grateful acknowledgment of help and encouragement is hereby made to Mr. Jesse W. Nelson, Assistant Regional Forester, and to the many forest officers and others who have so readily given

information. The opportunities offered during grazing reconnaissance enables one to cover closely large areas having wide variation in elevation, aspect and vegetative cover, and while the subject material presented is by no means complete, it is offered with the hope that a much more exhaustive study can be made in the future.

"We should everywhere maintain a working coöperation between the government and the private owners of timber lands that will make reforestation economically feasible. This involves at least two things—state coöperation in fire protection and a system of equitable taxation that will stimulate private enterprise in the growing of forests. We cannot expect private capital to risk vast investments in reforestation if these vast investments must be left at the mercy of a casual cigarette stub. And timber growing must be taken out of the situation it has all too often had to face—a situation in which a timber crop has been taxed over and over again during its growing period. We must realize in all of our states that we cannot force private corporations to grow forests for public benefit unless the public coöperates in making the growing economically feasible."

—(From *American Forestry*.)

GLENN FRANK,

President, University of Wisconsin.

FOREST CONDITIONS IN WEST VIRGINIA

By H. S. NEWINS

Chief Forester, Game, Fish and Forestry Commission of West Virginia

In this article the author reviews the forest conditions of mountainous West Virginia, and calls attention to opportunities presented there for forestry practice. He describes the major life zones particularly as to the tree species and discusses the results of sample plots located in the several soil types of the region.

NATURE HAS bequeathed to West Virginia many natural resources which are of inestimable value to mankind. The forest cover of the Appalachian system of mountains within the state is the source of streams carrying health and wealth to far distant communities. The great bituminous coal fields of West Virginia, like those of Pennsylvania, are known throughout the world and will become more renowned as the numerous by-products available from coal may come more into vogue. The oil and gas fields of the state likewise supply industry and comfort to public welfare and will supply, in the future, many new products which are now in the experimental stage. Throughout the mountains of the State there are the ever-pleasing vistas of scenery to charm the tourist, and within the very heart of some of the mountains there are hidden caverns that have been only partially explored and which we are informed will eclipse in natural grandeur any caverns already explored and developed elsewhere. All of these varied resources combine to contribute to the requirements of industry and to the pleasure of man but the most wonderful heritage of all is the forest, which, when placed under the skilled management of modern man, may be made inexhaustible in the sense that one stand after another may be harvested without interfering with the perpetuity of the forest.

More than sixty per cent of the total land area of West Virginia, or 9,213,015 acres, is estimated to be potential forest land and includes all forests and cut-over land of the state. More than one million acres of this amount is in merchantable timber and the balance consists of cut-over lands and farm woodlots. Table 1 gives a classification of land uses.

The average altitude of the state is 1,500 feet, which is the highest average altitude of any state east of the Mississippi River. The lowest point in the state is the low water mark of the Potomac River at Harpers Ferry, 260 feet above sea level, and the highest point is Spruce Knob, near Circleville, 4,860 feet high. This range in elevation of 4,600 feet is equivalent to a difference of more than 15 degrees of latitude and more than two weeks difference in growing seasons. The yearly average of temperature is 52 degrees and the annual rainfall averages 45 inches. These factors provide ideal conditions for the future application of forestry in West Virginia. Coupled with these are the advantages of geography which should

offer ready markets for the forest products of the state. A five-hundred-mile circle, drawn about the geographical center of West Virginia encloses almost one-half of the entire population and better than one-half of the wealth, manufacturing plants, wages, and incomes of the United States. The climatic conditions prevailing within the state and the accessibility to markets are certainly attractive inducements to the future practice of forestry. It has been estimated that West Virginia produces at present 300 board feet of lumber per capita and of this amount 200 board feet is shipped to the markets outside of the state. The veritable storehouse of nine millions of acres of forest land located in the industrial heart of the nation affords ample opportunity for at least the contemplation of what might be achieved in forestry under the ideal and perhaps Utopian plan of forest management for which all foresters are striving—a plan in which forest taxation and many other knotty problems will be solved.

Three general life zones are represented in West Virginia: (1) The Canadian life zone; (2) the Carolinian life zone; and (3) the Alleghenian life zone.

1. The Canadian life zone covers large areas upon the mountains and plateaus above three thousand feet in elevation, where the characteristic species are: red spruce *(picea rubra)*, hemlock *(Tsuga canadensis)*, and yellow birch *(Betula lutea)*, with some balsam fir *(Abies balsamea)*. The spruce forest as such is found in pure stands at elevations above three thousand five hun-

TABLE 1

AREAS OF THE DIFFERENT TYPES OF LAND IN WEST VIRGINIA

All land, acres		15,374,080
Land in railroads	40,000 acres	
Main highways	39,330	
County roads	120,000	
Cities and towns	75,000	
Miscellaneous	35,000	
Total land outside of farms, timberland, etc.		309,330
All land in farms, forests and industrial sites		15,064,750
All land in farms	8,979,847	
Land outside of farms	6,084,903	
Farm woodlands	3,139,015	
All forests and cutover land	9,213,015	
Merchantable timber	1,100,000	
Cutover land and farm woodlots	7,841,818	
Farms not in woodland	5,810,832	
Idle and cutover areas	4,634,000	
Federal forest land	278,371	
State forest land	16,000	

The National forest lands in West Virginia are included in this discussion and consist, up to this date, of all but 10,000 acres of the Monongahela National Forest and include a portion of the Shenandoah National Forest. The purchase units in West Virginia for these two forests, as determined by the National Forest Reservation Commission, total 819,100 acres, of which 330,380 acres have been approved for purchase at an average price of $3.40 and 278,371 acres have already been acquired at an average price of $3.25.

red feet. It has been estimated that ie original spruce forests of West Virinia covered an area of one million five undred thousand acres. An early pubcation dealing with these West Virinia spruce forests refers in 1891 to the eduction of these forests to one-half the riginal amount, or to seven hundred fty thousand acres. This area has since een so reduced by lumber operations nd the ravages of fire and insects that can safely be stated that a bare vestige f the original forest remains. It is inresting to note that the species of pruce under discussion in this earlier ublication was referred to as black pruce. The name is in error in the parnce of modern foresters because the pecies referred to is really the red pruce *(Picea rubra)* and not black pruce *(Picea mariana)*. The black pruce is rarely found in the state and restricted in its local occurrence in e United States to cold, sphagnum vamps.

The spruce forests of West Virginia ave been exploited largely to supply e great demands for pulp wood and r the many valuable forest products hich may be obtained from this excelnt lumber. This species, among others, as specified by the U. S. Air Service uring the world war for use as wing am stock in combat airplanes. At the nclusion of the war the high class ear lumber which had been assembled the West Virginia lumber yards for ar purposes was graded as "Export ock" and largely shipped abroad.

Because of certain insect infestation d the continued exploitation of the ruce forests since the advent of lumring in the high Alleghenies of West Virginia, and particularly on account of the devastation wrought by fire, there are very large areas in this spruce type of cut-over land which should now be reclaimed by planting. Many of these forest lands have already been included in the purchase areas of the Monongahela and Shenandoah national forests. Spruce seedlings are produced at the U. S. Forest Service nursery at Parsons, West Virginia, for planting on the devastated lands within the national forests.

The yellow birch and hemlock of the Canadian Life Zone are usually not found above 3,500 feet in elevation except where pockets of additional soil occur.

2. The Carolinian life zone is the lowest in elevation and covers more than one-half of the state. This zone is typified by such species as sassafras *(Sassafras variifolium)*, red bud *(Cercis canadensis)*, yellow poplar *(Liriodendron tulipifera)*, persimmon *(Diospyros virginiana)*, Virginia scrub pine *(Pinus virginiana)*, and some short-leaf pine *(Pinus echinata)*. The oaks *(Quercus* spp.*)*, chestnut *(Castanea dentata)*, hickories *(Hicoria* spp.*)*, walnut *(Juglans nigra)*, black gum *(Nyssa sylvatica)* and the maples *(Acer* spp.*)*, are also abundant in this zone. West Virginia has been the proud leader of all states in the production of chestnut lumber since the year 1909, when first place was conceded to this state by Pennsylvania. During the year 1913, West Virginia produced as much as 136,283,000 feet, board measure, of chestnut lumber. The remaining forests of chestnut in the state are already infected in most cases with the chestnut blight disease *(Endo-*

thia parasitica) which has made such serious inroads into the chestnut forests of the eastern United States since its discovery in the United States during the winter of 1904-05. Experiments are now being conducted in West Virginia, in coöperation with the U. S. Department of Agriculture, to eventually determine the adaptability and resistance of Chinese and Japanese species of chestnut.

3. The Alleghenian life zone is intermediate in elevation and includes an overlapping of species from the life zones above and below. Beech *(Fagus grandifolia)*, birch *(Betula lenta* and *Betula nigra)*, and maple *(Acer* spp.) are associated in this zone with chestnut, walnut and the oaks, while hickory and butternut *(Juglans cinerea)* are also common, and white pine *(Pinus strobus)* is represented in scattering stands.

The Carolinian and Alleghenian life zones are for convenience in this brief paper considered together and include as mentioned above, the oaks, chestnut, yellow poplar, maple and basswood *(Tilia heterophylla)*, as well as the other important hardwoods which have made West Virginia famous for the "soft textured" woods supplied by this mountain state. The distribution of these species may best be considered by a brief review of the sample plots which were studied during the summer of 1927 in Nicholas and Webster counties in connection with a land utilization survey carried on in the southeastern portion of West Virginia by the Division of Land Economics of the U. S. Department of Agriculture and in coöperation with the West Virginia Agricultural Experiment Station and the Branch of Economic Research of the U. S. Fores Service. The conditions which were ob served in these two counties will reflec the general conditions prevailing in these life zones elsewhere in the state.

The plots which supplied these dat were distributed over the principal soi types of the region, which included (1) DeKalb stony loam; (2) DeKalb sil loam; (3) DeKalb stony silt loam; an (4) rough stony land. Other soil type which were less generally representee are (5) DeKalb loam soil and (6) Up shur stony silt clay loam. Thirty-fiv species of trees were identified upo these plots; twenty-one of these may b considered as of commercial import ance, sixteen of which comprised prac tically the entire stand of each of th main soil types studied. These sixtee widely distributed species are as fol lows: beech, birch, yellow poplar, ches nut, soft maple *(Acer saccharinum)* black oak *(Q. velutina)*, basswood chestnut oak *(Q. montana)*, white oa *(Q. alba)*, black gum *(Nyssa sylvatica)* white ash *(Fraxinus americana)*, blac locust *(Robinia pseudacacia)*, butter nut, sassafras, sycamore *(Platanus occi dentalis)* and hemlock.

The only exceptions to this genera distribution are that hemlock and syca more are not found on the DeKalb ston loam and sycamore is missing also o the DeKalb silt loam soils. Both thes species occur more frequently on th lower slopes adjacent to the large streams where these two soil types ar not generally present.

Chestnut, together with chestnut oa black oak and locust, forms the greate proportion of the stand on the DeKal stony loam type whereas soft mapl

white oak, sourwood *(Oxydendrum arboreum)* and sassafras seem to occur in greatest quantity upon the DeKalb silt loam type and yellow poplar, basswood and butternut constitute the highest percentage of total distribution on the DeKalb stony silt loam soils. Yellow poplar is well distributed over the latter soil type, butternut is found more commonly in coves and on slopes, while the basswood is generally found on the ridges. The white oak on this soil type is second in extent only to that of the DeKalb silt loam type; chestnut is also found here in abundance.

The rough stony land type of soil supports chiefly beech, birch, black gum and ash, and, with the exception of the black gum, these species are located mostly on slopes and in coves.

The DeKalb loam soil type is confined to relatively small areas and is of patchy occurrence on ridge tops. The Upshur stony silt clay loam is characterized by the presence of yellow poplar, walnut, butternut, hickory, beech, maple, black locust and black cherry *(Prunus serotina)*, with a predominance of yellow poplar. Sycamore, ash and mulberry are also present.

The effect of altitude upon the distribution of spruce and the dominance of the softwoods at the higher elevations have already been discussed. With reference to the hardwoods it may be remarked that those which are found at higher elevations in the hardwood types are also well represented at lower elevations, but the reverse is not always the case, as is illustrated by the absence of such species as persimmon, red bud and red gum at the higher elevations, although these species are present at lower elevations.

A study made of the sample plots in so-called "virgin" forest areas in the vicinity of small farms reveals that they have been slightly culled for domestic purposes but are otherwise similar to larger areas of virgin stands, except that their proximity to the farmer has generally resulted in better fire protection. The stands represented by these plots will run from 12,000 to 25,000 feet, board measure, per acre, depending upon the species, site, and the seriousness of the fire damage. This volume is chiefly made up of diameter classes from 12 to 24 inches, with the result that the smaller diameter classes of from 4 to 12 inches are thereby severely suppressed.

Within what may be called the cut-over forest, in contrast to the virgin forest, the plots were examined in three different classifications; (1) where the stand had been lightly culled, (2) where the stand had been cut to a rough diameter limit, and (3) where the stand had been heavily cut. It is evident from a review of the study of the lightly culled forest that the trees selected were cut at an earlier date when only the best species such as yellow poplar, white oak, walnut, black oak and chestnut were logged, and usually only those above 18 inches at the stump were considered. The defective trees which were invariably left standing afforded no relief from suppression to the greater number of trees which were still in those diameter classes under 12 inches d. b. h., and consequently the younger trees were not stimulated to make any exceptional growth.

The stands which were cut to a rough diameter limit were exploited at a later date, 10 to 25 years ago when transportation facilities enabled the operator to remove trees varying from 18 inches down to 12 inches on the stump—the limit seems to have averaged 16 inches, especially at the earlier period of this stage of cutting.

The stands which have been heavily cut are of more recent history and reflect the influence of the larger and more modern band mills. They reflect the influence also of the recent portable mills which have skimmed over the previously exploited forest for a second cutting and have removed any portion of the growing stock which might have an immediate value to themselves. Because of these tendencies the portable mills have frequently been referred to as "bootleg" or "shoestring" outfits. In these stands which have been cut over by the operations of the large band mills and by these "bootleg" portable mills, fully seventy-five to ninety per cent of the remaining trees are 10 inch d. b. h. and under. The total residual volume in these cases averages 2,000 to 4,000 board feet per acre and one-third to one-half of the remaining trees are defective.

A review of all of the various plots studied indicates that those stands which were exploited by the rough diameter limit method of cutting have been left in the best silvicultural condition.

Perhaps the most obvious lesson to be learned from the review of all of these field plots is the contrast which exists between those on burned and on unburned areas respectively. These data show very conclusively the disastrous effect of fire upon the silvicultural condition of the forest. Fortunately an educational campaign is under way in West Virginia to protect the forest from fire, but judging from the difficulties incurred during the drought year of 1930 there is much yet to be accomplished. However, the federal government is coöperating actively with the office of the State Forester through the terms of the Clark-McNary law of 1924; also there are two distinct and very effective forest fire associations in the state which include under their supervision a combined total of more than 1,900,000 acres of forest land, all of which is receiving forest fire protection.

West Virginia needs tax relief, an expansion of the research program, the development of a larger nursery and reforestation program, a land acquisition policy and many other forestry measures; but none is more important at this time than the expansion of the program of forest fire protection in order to insure to the posterity of West Virginia the conservation of this magnificent heritage of potential forest land.

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WHAT PERMANENT FORESTS MEAN TO THE RAILROADS OF ARKANSAS[1]

By P. T. COLE

Agricultural Commissioner, Cotton Belt Railroad

The importance of forests to the railroads as sources of their bridge, road bed, and general construction material and as a permanent source of freight traffic and revenue has never been adequately investigated. In this article are given a few facts bearing on the inter-dependence of forests and railroads.

PRODUCTS of the forests constitute a very important portion of freight tonnage moved by the railroads of the Southwest, and any well directed plan or program for encouraging permanent reforestation is of vital interest to the railroads of this state and to the nation.

Most of our railroads were not built for the purpose of handling traffic over a limited period of time, but were constructed as permanent fixtures to serve the respective communities through which they run for all time to come. So, naturally, they must look forward to future developments which will bring increased tonnage and new business.

Some of our railroads, however, were originally built primarily for the purpose of handling products of the forests, but as the land was deforested fields were cleared and the land developed agriculturally. The railroads have played a very important part in the early settlement and development of new country. As these roads pushed farther into the virgin forests, agricultural development followed, schools and churches were established, and later these were followed by manufacturing enterprises.

Although the forests do not play so important a factor in furnishing traffic as they once did, yet the volume of traffic furnished is of sufficient size to command special attention.

Records show that in 1912, 75,000,000 tons of forest products were moved by the railroads of the nation from a total of 927,000,000 tons all traffic moved. While in 1923, the peak year for forest products, the huge sum of 115,000,000 tons were moved out of the sum total of 1,280,000,000 tons all traffic moved.

Forests mean much more to some railroads than others, as certain sections of the country are especially adapted to the growing of trees while other sections are more or less originally prairie or have been cleared for agricultural purposes. For example, take the earlier settled section of the eastern part of the United States. For the year 1926 forests furnished them less than 3 per cent of the tonnage originated, while in the South, forest products accounted for 15 per cent of the total tonnage originated.

To carry this idea a step farther, we

[1]Presented at the First Arkansas Extension School of Forestry, Pine Bluff, Arkansas, December 11 and 12, 1930.

also find that certain individual railroads are so located in certain sections that forests mean much more to them than they do to other railroads not so favorably located in the same general section.

Table 1 will be interesting as an illustration:

TABLE 1

PER CENT ALL TONNAGE CARRIED BY SEVERAL RAILROADS, 1926

B. & O.	4.3 per cent
C. & O.	3.0 " "
P. R. R.	4.0 " "
C. M. St. P.	19.7 " "
Mo. P.	15.9 " "
Southern Pacific	24.1 " "
Cotton Belt	25.48 " "
Southern	17.9 " "

A comparison of forest products tonnage handled by railroads in different sections of the country is given in Table 2.

TABLE 2

FOREST PRODUCTS TONNAGE HANDLED BY RAILROADS, AND REVENUE SOURCES

	1928	Per cent all traffic
United States	96,736,937	7.5
Eastern district	11,150,935	2.2
Southern district	55,807,672	15.5
Revenue received by railroads, 1928		
Forest products		$363,617,993
Agricultural products		738,276,369
Animal products		242,638,667

In 1929 the railroads purchased for their own use 20 per cent of all the timber sold. Naturally they have an interest in forests and in their economic preservation. They believe in conservation, and many of them are giving attention to programs that will tend to lessen the destruction of forests by fires, while at the same time they are putting into practice the treating of timber to prolong its life and service. In the case of our own railroad, it is the policy to use nothing but treated ties, pilings and bridge timbers.

Although we are living in an age of invention and substitution, there is yet no definite evidence of a suitable substitute for the wooden tie. A systematic method of forestry can be made to insure good, cheap ties for the railroads for a long time to come.

As the production of lumber lessens, chemistry is finding new ways of wood utilization.

At no far distant time we are promised white newsprint from southern pine on a commercial scale. This means tonnage in the way of raw material and manufactured products. Clothing from spruce wood is not uncommon now. The chemist promises it from pine in the near future.

Products such as Masonite, fabricated

TABLE 3

FOREST PRODUCTS USED ON ST. LOUIS SOUTHWESTERN RAILWAY LINES DURING YEAR 1929, ESTIMATED.

	DIVISION		
	Northern	Texas	Total
Bridge timber, board feet	1,950,153	1,215,046	3,165,199
Building material, board feet	504,678	843,174	1,347,852
Piling, lineal feet	86,008	64,908	150,916
Cross ties, pieces	388,225	346,275	734,500
Switch ties, board feet	1,147,590	753,385	1,900,975

water pipe, twine and wrapping paper are now common. Such industries based on permanent forest production mean stable towns and contented, prosperous people; which, in turn, mean prosperity for the railroads.

The South is recognized as the most desirable section in the United States for permanent forestry development. In most of the European countries forests are guarded with great care. When a tree is cut another must be planted to take its place. The young trees are carefuly guarded against fires and even rolling lands planted to trees are terraced to protect against undue soil erosion. Timber is not wasted. When a tree is cut even the bark and small limbs are saved and utilized, and nothing is wasted by burning as is the common practice in our own country.

The President of the Erie Railroad, Mr. C. E. Denny, makes the following statement relative to fires: "Every railroad employee should know of the fire dangers to life and property and the methods by which most fires can be prevented. Fire has been called our greatest economic burden. Fire annually kills ten thousand Americans and destroys half a billion dollars in property. This staggering waste of human life and material wealth cannot be permitted to continue without seriously impairing our boasted national efficiency. Seventy-five per cent of the fires are preventable, a shocking indictment of our carelessness".

This statement applies to the protection of our forest land as well as to our homes, business buildings and factories.

In conclusion, let me quote from a statement made by our own Mr. Daniel Upthegrove, President of the Cotton Belt Railroad, relative to the importance of forests and their conservation:

"Forests are the very foundation of our civilization. An enduring civilization depends upon enduring forests. The railroads realize that hardwoods, particularly oak, make the best cross- and switch-ties. Formerly, the Cotton Belt used only white oak, from which we obtained a life of from six to eight years. We realized the superior value of white oak for industrial uses, such as furniture, flooring, automobiles, etc., and we are now using other species of wood not so valuable commercially; and we now creosote the ties, which gives them a life of twenty years or more. In 1910 this company applied 825,000 untreated ties and 250,000 treated ties, which took 17,500 acres of land to produce. In 1926 we applied 2,800 untreated ties and 620,000 treated ties, which took 10,309 acres of land to produce. In other words, we saved by this method each year the timber from about 7,500 acres of land.

"From a public standpoint, and as a representative of one of the big users of forest products, I regard conservation as a matter of national importance. As our population increases the demand for hardwood timber will increase, provided there is the proper conservation of the supply and its superiority over substitutes is properly emphasized and kept before the people".

COMPRESSION WOOD RECORDS HURRICANE

By M. Y. PILLOW

Forest Products Laboratory,[1] *U. S. Forest Service*

Compression wood causes many difficulties in those boards in which it is present. Its exact cause remains in doubt; any new suggestion, as the present one, therefore throws light upon its probable origin.

A SUDDEN change occurred in the woody tissues formed in a stand of longleaf pine coincident with the time that a hurricane swept across Florida in the fall of 1926. This tissue showed under the microscope to be an

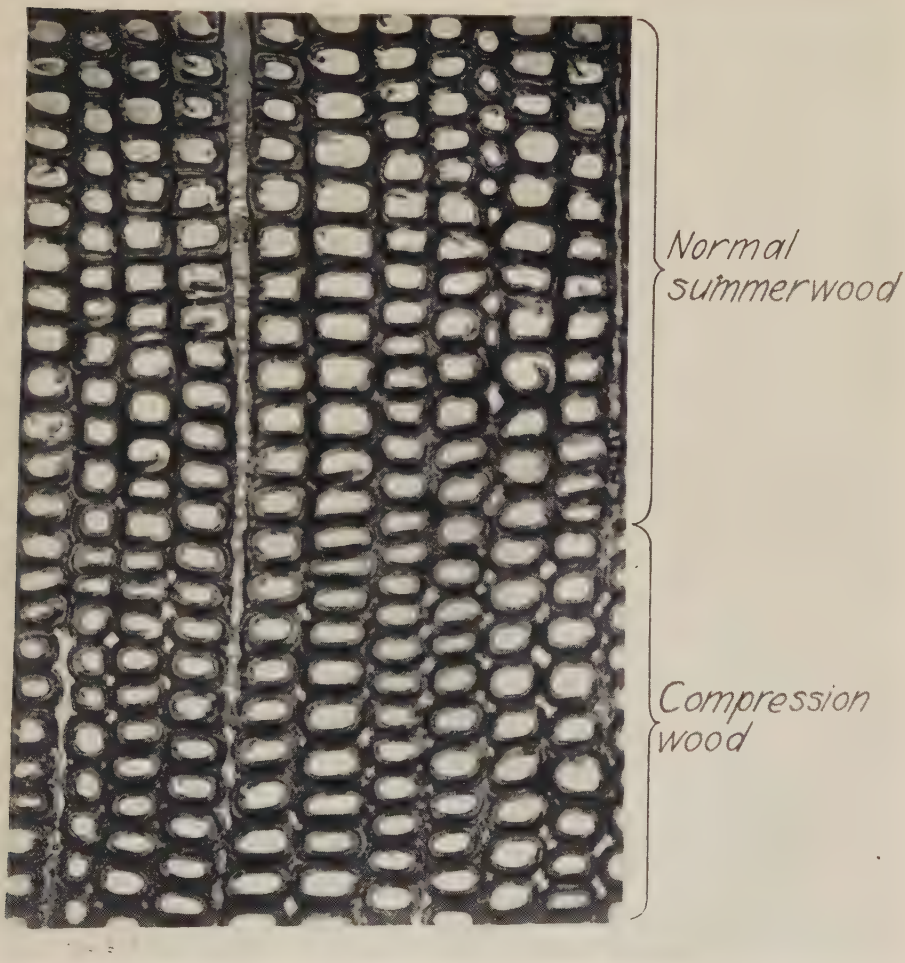

Fig. 1.—Photomicrograph of a cross section of a portion of the 1926 growth ring in a Longleaf Pine from western Florida. The normal summerwood cells were formed before the hurricane occurred and the compression wood cells abruptly thereafter.

[1]Maintained at Madison, Wis., in coöperation with the University of Wisconsin.

Fig. 2.—Photomicrograph showing the spiral cracks in the cell walls of the compression wood. This longitudinal section is from the same portion of the annual ring as shown in figure 1.

abnormal type of wood called "compression wood".

Compression wood commonly occurs in coniferous trees on the lower sides of leaning trunks and on the under sides of branches. It is distinguishable from normal wood by its relatively wide annual growth rings and by its "lifeless" appearance. Although the summerwood in compression wood is usually greater in amount than in normal wood, it is not so hard nor so flinty in appearance. It is found on only one side of an annual growth ring, and since the annual rings are wider on the compression wood side, the ring is eccentric. Consequently logs containing compression wood usually have the pith to one side of the geometrical center. The microscopical appearance of compression wood differs from that of normal wood in that the cells are nearly circular in cross section instead of rectangular or polygonal and are commonly separated at the corners by intercellular spaces instead of being completely joined one with another. The cell walls of compression wood also have many spiral checks and striations, a condition not present in normal wood.

The longleaf pine stand that furnished material for these examinations was fully stocked, evenly spaced, and evenly aged (approximately 35 years). The trees ranged from 6.5 inches to 9.0 inches in diameter, breast high, and were from 60 to 70 feet high. Sections from the first 18 feet above the ground and the 18 feet next below a 3-inch top diameter were examined.

Compression wood had formed in some of the trees in the latter part of the growing season of 1926, but not during the earlier periods of that season. Figures 1 and 2 show the abrupt beginning of the compression wood as well as the microscopic characteristics by which compression wood is distinguishable from normal wood. The compression wood continued to be formed in 1927 in all trees that had produced it in the latter part of 1926 but in 1928 it had disappeared from some trees and had diminished in intensity in others. It was found in 33.9 per cent of the sections examined from the upper portions of the trees and in 6.5 per cent of the sections from the lower portions.

The summerwood formation (2) in the western Florida region occurs during the period beginning in early summer and extending to late fall. By forming considerable normal summerwood at first and later compression wood the trees recorded the approximate time at which they were forced from their vertical position as being in the latter part of the growing season, that is, in early fall. This time coincided with the time that the hurricane struck the region. The trees remained in a bent position for some time.

This investigation offers a possible explanation of why compression wood may occur in narrow streaks within a single piece of lumber or may shift from one sector in the cross section to another. In addition these trees have indicated that in this fully stocked, evenly-spaced stand, the greatest effect of the winds was bending in the upper portions rather than a partial uprooting and tipping of the entire tree, since a greater number of the trees had compression wood formed in only the upper portion as a result of the storm. A

similar occurrence of compression wood was reported by Hartig (1). He observed that spruce originally grown in a dense stand that was later opened up by an insect attack produced compression wood mainly in the upper portions. The crowns had been greatly reduced from the bottom upward by the density of stocking and by the insect attack so that the wind forces acted primarily upon the relatively small remaining portions at the very tops of the trees. Other observations have shown that compression wood is usually more frequently found in the lower portions of the stem and that even in trees that are inclined in the lower portions the upper ones are very often nearly vertical and therefore do not form compression wood. In the Florida trees, because of their small size and positions in the full-stocked stand, the effect of the wind was most pronounced in the upper portions.

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OBSERVATIONS ON DANISH AND GERMAN FORESTRY

By G. B. SHIVERY

Extension Forester, Tennessee

Many foresters are asking the question "under what conditions can forestry be remunerative?" This article in a striking way, points to the factors that operate to make intensive forestry feasible and remunerative in certain sections of two European countries. Favorable markets there permit of very close utilization while the growing capacity of the soil is high. The author found that Danish and German foresters derived much of their income from thinnings and that they were very attentive to soil management.

Forestry in Denmark

DANISH FORESTRY really dates from the year 1905. Prior to that year all farm land was held in common and forest land received no attention and produced little, being simply a roaming place for "creatures" and domestic animals. In that year, by blanket edict, areas were blocked out as forest land in perpetuity and at the same time the agricultural land previously held in common was divided among the peasants of the several communities so that each man became a property owner. Aside from these common areas, there remained the crown lands which include the estate properties in Denmark. Incidentally this background of ownership in common may explain the present ready acceptance of the coöperative marketing principle, which is well developed in their export of butter, eggs, and pigs. For taxing purposes, land is graded in fertility on a scale running from 1 to 24. Land formerly in crop production can be converted into forest use, provided it is not over 6 in this scale. A few old fields have been taken in by purchase according to this arrangement on the Frijsenborg Estate in Jutland. The state will bear one-half of the cost of putting forest trees on such land provided the owner pays the other half of the expense.

Although Denmark is primarily a producer of agricultural products for export to England, one finds her intensive forest practices and close utilization extremely interesting. The total area in forest is 1,000,000 acres, of which 250,000 acres is owned by the state. The bulk of the remainder is owned largely as parts of Crown Estates.

The Frijsenborg Estate at Hammel, Jutland, comprising 11,367 acres in forest and 2,718 acres in cultivated farm land, is an example of really intensive systematic thinning or "garden forestry". There are two foresters and eleven rangers employed on the forest property, each ranger having a home and, in some instances, no more than 300 acres to manage. Here there is an annual rainfall of 28 inches, more than in most parts of Denmark. The climate is humid with cold winters, although the snow is not especially heavy. Frosts occur in June and in September. Prevailing high winds also are a factor to be considered in their system of silviculture.

The principal species of trees are beech, Norway spruce, silver spruce, larch, and our West Coast trees like *Abies grandis, Abies concolor,* Sitka spruce, and Douglas fir.

Douglas fir propagated from seed of the Queen Charlotte Islands, off British Columbia, stands first among the imported trees in rapidity of growth and other good characteristics. Of course, Norway spruce has a prominent place in their forests. Sitka spruce grows rapidly and has good form. It withstands wind better than Douglas fir. European larch to a small degree and Siberian larch even more largely are affected by canker and for that reason are superseded by Japanese larch. *Abies grandis* is a very good tree, but *Abies concolor* is not desirable because it grows too slowly. The rotation for beech was stated as being 120 years, silver spruce 80 years, while Douglas fir becomes very large at 70 to 80 years. The largest trees on the estate were in a stand of silver spruce 121 feet high and 100 years old, containing 11,854 cubic feet per acre.

The high winds affect the spruce and fir, breaking or injuring the roots so that the red-rot fungus (*Polyporus radiziperda*) spreads upward through the bole of the tree, causing defective and cull wood unfit for excelsior. These winds also dry out and devitalize the soil. Skovrider (Forest rider) Biilman maintains that conifers can be grown indefinitely without injury to the soil, disagreeing with the Germans in this respect. The Danes, by frequent thinnings, gradually open up the stand, admitting enough light so that the soil again becomes incorporated with organisms and in good physical condition. I noticed time and again that exactly such a transformation was possible, indicated in its first stage by the growth of *Oxalis* in a stand after thinning.

At one point in a soil section, Skovrider Biilman explained in detail the ash-gray appearance of the third horizon about 12 inches below the surface, illustrating how the soil was dead and sterile. We proceeded further to an experiment where he had pigs enclosed in a very open beech grove to root up the soil in order to secure a catch of beech during the next seed year. The Danes conscientiously guard their forest soil, and strive to improve it. No leaf litter is removed from forest land on this or the other estate visited in Denmark.

The annual cut on this forest amounts to 1,483,209 cubic feet per year. Utilization is very close, the best grade of beech from the thinning operations being used for making wooden shoes, and also butter casks or kegs, with the lower grades used for firewood. This beech for butter containers must have a diameter of 7.1 inches and be free from defect. It has a sale price of $16.47 per cord while firewood brings $9.70 per cord. The material removed in the thinnings of spruce and other soft woods is made into excelsior or shavings used for packing eggs for export to England. Defective wood and wood infected with red-rot root fungus is not suitable for this purpose and must be included in firewood.

Thinnings are the impressive feature of Danish forestry, as seen on this Estate. The principal of their silviculture is like the German idea, continually

to reserve the best specimens for production of quality sawlog material. Yet the major portion of the forest income of this Estate is from thinnings. In fact, the rule here is to make a thinning, in most cases, every second year when 15 to 20 per cent of the volume of the stand is removed. For each thinning, a simple record is made before and after cutting of the average height and diameter, the number of trees per hectare, and the total contents in cubic meters per hectare.

Records of this kind indicate that Douglas fir yields from 428 cubic feet to 572 cubic feet per acre annually between successive thinnings. Sitka spruce will produce as high as 572 cubic feet per acre while Japanese larch attains 296 cubic feet per acre per year.

We looked at a 35-year-old stand of beech in which 17 to 22 per cent of the total contents had been removed the past winter. A stop was made at a thrifty young stand of *Abies grandis,* 25 feet in height, where a thinning had just been made. In three years it will be thinned again. We observed a 46-year-old stand of Norway spruce which is thinned every second year. It will attain an age of not more than 70 years before it will have been completely removed. Next came a 40-year-old stand of Sitka spruce. This particular stand of spruce grows 556 cubic feet per acre annually. This estate, as do others in Denmark, maintains plots where trees are numbered and the amount of growth accurately recorded by measurements. During our stay, I had opportunity to see stands in which the trees to be removed had been marked with the Danes' special marking tool. These sample markings assisted greatly in observing the character of trees removed in their thinning operations. The only instance we observed where thinning or cleaning work had been done without any return was in the case of a thicket of beech 12 to 14 feet high, where it had not been possible to utilize the small wood removed.

The general practice is to depend on artificial planting rather than natural seeding. Forest tree nurseries were advantageously located over the Estate. Most young trees are set as 2-2 stock, although often larch and Douglas fir are large enough after two years in the seed bed. All the beds sown in May of the past year were screened and protected against late frosts. When the seedlings are planted in the field, they are arranged in rows, three feet apart, with a spacing in the row of 6 to 8 inches between plants. On another estate, a special tool was in use for loosening the soil in the rows preliminary to planting or seeding. Its purpose was to save labor since the cost of labor in Denmark is considered high. This tool had been used in a recent planting where oak seed-spots alternated with beech seedlings.

As protection against possible frost injury to young seedlings, a cover of birch or *Alnus incana* is interplanted with the seedlings of the species ultimately to form the stand. We saw birch used as a nurse crop for young beech. At another place, we saw alder used as a protective covering over ash, 6 years old from seed. There was but a single example of natural seeding on this forest, a case of spruce coming in on a northern exposure. The strip

method at right angles to the slope extending upward from the bottom was resulting in reproduction being established from the trees higher up the slope.

On the Svendstrup Estate at Borup, out from Copenhagen, we found Skovrider Muus concentrating growth on chosen specimens in order to increase the per cent of income from forest land. He emphasized his reproduction system in which the ground is harrowed before a heavy seed year, resulting in a wonderful catch of beech seedlings. This beech is then present on the ground in a thrifty condition, though with little growth, while the overstory of selected best-quality trees lay on high priced wood. Where ash is grown, it is in mixture with beech because ash alone is not considered good for the soil. Ash timber is desired especially because it is worth $2.45 per cubic foot compared to $1.22 for beech.

The necessity of having available markets for the products of a thinning was brought out forcefully on this Estate in the case of a stand of Norway spruce planted in 1880. Up until the time of the World War, it was not possible to thin out this stand since no market presented itself. At that time, England wanted pit props, and a very heavy thinning was made at a large profit. The stand is now thinned every second year, yielding 714 cubic feet per acre each time.

Forestry in Germany

Forestry in Germany had its origin when a wood famine appeared imminent about 1800, so that at the present time the people are thoroughly "forest minded". All forest roads are built and maintained either by the state or by the town and they are permanent. They are therefore not charged as an expense to the forest owner. This item is of great consequence in their successful management, a fact which is usually overlooked by visiting Americans.

A general rule in German woods practice is to save the best tree specimens to grow to saw-log size. They continually remove the poorer trees by systematic thinning, since fuel wood is much in demand. Even though the Germans are adept at thinning, I obtained the impression that emphasis was laid rather on their series of preparatory cuttings to secure natural reproduction.

The Communal forests of the villages Lindenfels and Beerfelden i/o Odenwald, Hessen, proved very interesting. At Lindenfels, Forstmeister Dr. C. A. Schenck explained the progress of reproduction cutting on an area on which forestry had been proceeding during his entire lifetime. The stand was hardwood—mostly beech, which had come up thick and dense as a result of the partial cuttings which served to open up the stand gradually and encourage reproduction. Three distinct levels proceedings from the top of the slope downward were plainly visible from an observation tower. This controlled natural reproduction in each instance has proceeded to a line, marked by a road, and no farther. The different portions had been thinned as needed through the years. At the bottom of the slope a fourth small compartment remained to show a part of the old timber

yet standing, with the new reproduction well established as a result of the partial removal and opening of the mature stand.

German foresters would like to grow conifers or softwoods because they are more profitable than beech. However, since at Lindenfels each family is entitled to one cord of firewood every year of a value of about $25, the management of the communal or town forest is directed largely toward the growing of beech. At the same time their experience has been that pure stands of conifers deteriorate and devitalize the soil over long periods of time, so that the present tendency is to return to a mixture of conifers and broad-leaved trees like beech.

At Beerfelden we saw stands of Scotch pine and spruce. Here close utilization is the secret of the income from the communal forest which goes into the village treasury. All wood products were stacked, piled, or laid out so that their contents or number was plainly visible. A thinning had been made in the spruce where there were bundles of bean poles, stacks of bakers' wood, corded short lengths for box boards, poles, and finally logs for lumber, all easily accessible to the forest roads to be sold to the highest bidder.

In Odenwald the species vary according to site. Spruce thrives best on moist north and east exposures, as does beech, while American white pine and Scotch pine can endure the drier south and west slopes. White pine and Douglas fir (Pacific Coast type) grow very well in this section of Germany. White pine blister rust is present though not enough to be damaging. We also saw thrifty specimens of northern red oak and hemlock, other introduced American species.

The Black Forest out from Baden with its solid dark masses of spruce, *Picea excelsa*, is indeed impressive. The country is hilly to mountainous, with the Mung River and its tributaries draining the rounded ridges, hills, and ravines. The trees are taken out in their full length and carried on extended wagons to the mills in the small villages. There also were piles of short-length wood for sale and removal. We saw one area where there had been a blowdown. The trees had all been salvaged so that the stand had the appearance simply of a heavy thinning, everything except the small amount of branch wood having been utilized. At another point was the large Talsperre Storage Dam with a series of huge pipes to conduct the water into the power plant, two or more miles below. This forest appeared to furnish an ample supply of logs and wood for maintenance of permanent sawmills, pulp and paper plants, and other wood-working industries, without interference with its scenic and recreational possibilities and power development.

Summary

Refined forest practice in Germany and Denmark is based on close utilization. It is true they continually reserve the choice trees for growth into saw-log material, yet they are enabled to speed up this process and to obtain a major portion of their income by careful thinning. Of course, the absence of fire in their forests is a great incentive.

The presence of permanent roads is a necessity in getting out the wood products at frequent intervals. The permanent location of mills and small wood-using industries helps greatly in making the forest business a going concern.

The frequency of the thinnings, especially in Denmark, was a revelation. Here they dispose of low grade wood as fuel, using the better, larger beech for butter-tub wood and sound spruce for excelsior or shavings. The Danes are thus able to greatly increase the rate of growth in their forests. Although dependence is placed on artificial planting, there appeared to be a drift of sentiment towards natural seeding.

The soil comes in for great attention and their silvicultural practices are determined with this essential factor in forest culture in mind. In addition, wind and frost are important items which influence forest management, especially in Denmark. They also consider carefully the source of seed and know from experience that seed collection in a comparable climatic situation is of extreme importance as are also inherent differences. The introduction of American and other species has tended to focus attention upon the subject of seed source. For example, Douglas fir (Pacific Coast type) is highly regarded in both countries. Sitka spruce in Denmark and white pine in Germany are close seconds.

Finally, the people have become "forest minded", forced on them in the beginning by conditions peculiar to the particular countries.

THE NATIONAL FOREST SURVEY OF SWEDEN

By K. E. THORELL and E. O. OSTLIN

Swedish National Forest Survey

The Swedish National Forest Survey was described in a note in the March issue of this journal. Since it went to press the present article, by two members of the Survey, was received. It gives a more comprehensive description of the methods used in the Swedish survey and the essential facts, as determined by it, of the timber balance sheet of Sweden. The authors report that the data have already proved to be of incalculable value. Sweden's forest survey is of particular interest to American foresters in view of the huge survey recently begun by the United States Forest Service.

IN RECENT years one of the most valuable forest regions of northern Europe has been the subject of a significant investigation. We refer to the general inventory of the forests of Sweden which includes the area and the site-quality of the forest land as well as the cubic volume, annual increment and composition of the timber supply. This interesting work has been completed recently for the whole country and because of it the Swedes now have an extensive knowledge of one of their most important natural resources. As the forest conditions and the forestry of Sweden during the last few years have become well known outside the boundaries of the country, a short description of the general forest survey is given herewith. In this connection it is interesting to note that Norway and Finland have recently completed general forest surveys also, and that a survey has been started of certain sections of the forests of United States of America in accordance (approximately) with the method used in Sweden.

Time and again rough estimates of the timber supply of Sweden have been made. The results have, however, varied considerably owing to incomplete basic data and to the crudeness of the methods used. In 1907, however, a Swedish forester proposed that the old Swedish linear or strip survey method should be employed in the investigation of large forest areas. The mathematical reliability of the method was looked into and it was found that it might be expected to yield fully satisfactory results at a reasonable cost. Subsequently the method was further developed and tested by a trial forest survey of the entire province of Värmland, in Central Sweden, in 1911. This inventory was found to satisfy fully all demands as to accuracy and detail of results. As the strip survey method permits the assorting of the basic data by groups it was possible to test the reliability of the method with the aid of the calculus of probability, being the first time it was employed in connection with a linear forest survey. The Commission responsible for carrying out the trial survey in 1914 outlined a scheme for taking stock of the forests throughout the entire country. The immediate realization of this plan was, however, prevented by the War and the critical years that followed,

so that it was not until the period 1923 to 1929 that the Swedish national forest inventory could be made. In the course of this survey, the forests have been investigated in conformity with the method used in 1911, which, however, was further improved in 1923 by specially appointed experts. At first the inventory was carried on by the Swedish Forest Service, but in 1924 the management of this extensive work was taken over by a Royal Forest Survey Committee, which was subordinated directly to the Department of Agriculture. President of this committee is Professor H. Hesselman, Chief of the Forest Experiment Station in Stockholm, the managing member and secretary is Dr. J. Ostlind, Assistant Chief of the Royal Board of Pension. The other members are Professor T. Jonson, Dean of the Forest School in Stockholm and Mr. W. Ekman, President of one of Sweden's oldest and largest forest and lumber companies.

A nation-wide forest survey was suggested by some farsighted men, prominent in the science of forestry, in the forestry and lumber industries and in the forestry societies. They were of the opinion that more than the annual increment of the forests was being cut. (It may be mentioned that the depletion of the forests by fires and insects in Sweden can be left out of consideration, whereas in United States heavy losses are incurred by these agencies.) The main object of the survey was to ascertain the annual increment of the forests and with the aid of reliable statistics of timber consumption (as yet only crude figures are available but the work of getting up-to-date consumption statistics is rapidly progressing) a plan regulating the annual cut so that it would not exceed the annual increment. Moreover, information might be gathered as to what measures would increase the annual yield from the forests. It may be stated that the forests are the most important source of income in Sweden. Out of the forests alone come raw products for articles of export the value of which amounts to half the total sum of export of the country.

As the intention was to determine the timber supply of the whole country, both state and privately owned forests were investigated. According to the latest obtainable figures the forests of Sweden are distributed among different owners as follows:

	Per cent
States forests proper	20.1
Other public forests	3.8
Forests of limited companies	27.0
Forests of large landlords	3.4
Forests of smaller landlords	45.7
Total	100.0

Funds for the national forest survey were appropriated by the national parliament whose members have always treated this important question with great interest, regardless of their political opinion. Also everywhere in the country people were very much interested in this work and all classes eagerly awaited the results of the survey of the districts investigated during the year.

Sweden's total area, which is 10 per cent larger than the area of California, is divided as follows:

	Square miles
Land area	158.525
Lakes and rivers	14,625
Total area	173,150

Naturally the area of productive for-

est land of a whole state could not be obtained by surveying every acre, nor could each tree be counted, because this would take too long a time and cost too much. Instead a number of sample plots were laid out to cover the various provinces. As the topographical conditions of Sweden are very variable, these sample plots were given the form of long strips, 33 feet wide. These strips or lines were parallel and ran from boundary to boundary of the Kingdom or from coast to coast. The distance between the strips, which was determined on the basis of the results obtained as to reliability in the trial survey carried out in 1911, varied in north Sweden between 6.2 and 12.4 english miles and from 0.6 to 3.1 english miles in central and southern Sweden, where they ran west-east. In northern Sweden they were stretched from south-west to north-east. In this way the survey lines were, for the most part, drawn at right angles to the main topographical direction, and therefore different land classes were included in correct proportion to their extension. The survey lines, which were drawn up on good topographical maps, were followed in the field by means of a compass.

Along these lines the different surveying parties—10 to 12 men in each and with a trained forester as chief—move ahead and investigate the various areas. The total length of strip covered corresponds to a distance more than 1.25 times around the equator. This figure, however, does not include the distance between the clusters of islands, where motor boats were used, or the strip lengths over prairie land, where auto busses and also aeroplanes were used for reconnoitering. In the forested districts, of course, the surveying parties travelled their long way on foot and had carriers to transport tents, victuals and kitchen utensils. Here and especially in the desolate parts of northern Sweden they led a veritable wilderness life. In the more settled tracts, on the other hand, they took their lodgings with the country people. Every day the parties covered 4 to 5 english miles and every night they pitched their tents at a new place or took up their quarters at a new farmstead.

When a party worked its way through the forts the compass man came foremost, and with the help of his compass showed the party the way straight on over stock and stone, through swamp and morass, over lake sand rivers always straight on. He drew a drag-rope, 330 feet long, and within a distance of 16.5 feet on both sides of the rope all trees, with the exception of those of the smallest dimensions, were counted and measured by two calipermen. The data were recorded on a special form by a forest ranger who was also the foreman of the party. A certain previously fixed number of the recorded trees of each species and diameter class were automatically, that is to say without selection, taken out as sample trees. These were thoroughly investigated by a sample-tree-taker and his assistant. Everything in regard to height, taper, cubic volume, diameter and height increment as well as to age and defects the sample-tree-taker recorded for each tree on a separate card. The data of these cards was later used for calculating the cubic volume and increment of these and all recorded trees.

Along the drag-rope the lengths over areas of arable or productive forestland, pasture, bog, mountains, rock outcrops, lakes and rivers, gardens or roads, etc., was measured by two chain-men, the partyleader recording their measurements on a special form. The productive forest land was subdivided and classified according to productivity and as to the different forest types, and notes were made from the standpoint of forest management. The distance across lakes and rivers was determined by indirect measuring or by taking the length from the map. When crossing a lake or a river the men often had to fell trees and build a raft on which to transport themselves and their baggage.

From one to three carriers took care of and transported the baggage. On paths and roads, sometimes in boats, the carriers went along to the place intended for passing the night, while the survey party worked its way along the strip. All the time the supervisor of the field work controlled and checked the work of the different surveying parties. The procedure of checking was as follows: The last investigated 2-kilometer distance was resurveyed and a comparison between the two results showed whether or not the party was surveying with sufficient precision. Each summer 3 or 4 provinces were investigated by from 8 to 10 parties, covering each surveying-season an average distance of more than 4,600 miles.

Once each week the party leader sent the material collected to the office of the National Forest Survey Committee at Stockholm, where it was carefully checked. In the autumn when the field work was completed, rapid headway was made in the work of compilation. There were many thousands of forms and a great mass of data to be dealt with. Accuracy was the first and the last word heard in connection with the material of the National Forest Survey. About 20 persons were continually employed with the compilation, 10 of whom were women. The most up-to-date computing equipment was placed at their disposal. Thus not only the field work but also the office work was rapidly completed.

As mentioned, the surveying parties during the summers of 1923 to 1929, cruised a distance longer than round the equator, a belt of 32,300 english miles in length. At the same time they investigated not less than 180,000 sample trees. These are the total figures for all Sweden. In the autumn of 1929 the field work was completed with the resurveying of the province of Värmland, where the trial survey had been made nearly 20 years before. Thus all the provinces of Sweden with a total land area of 101.5 million acres were investigated in conformity with the same standard method, which, somewhat simplified and improved, was developed from the trial survey in 1911.

The results of the survey of the entire country were available in a fourth and final preliminary report to the King in December, 1929, only 3 months after the field work was completed. These four reports give a very detailed account of all that is interesting and important to know as regards the forestry conditions in the 24 provinces of Sweden. In the tables given, however, only the most important results are drawn together for the three large sections, Northern, Central and Southern Sweden (Norrland,

Svealand and Götaland), into which the country of old, both administratively and geographically, was divided.

In Sweden the total productive forest land comprises 57.3 million acres (41 million hectares), corresponding to 56.5 per cent of the total land area.[1] In the productive forest area pastured forest land is also included, but not broadleaf forests above the coniferous timber-line or other forests of poor growth, i. e., forest land with a yearly wood producing capacity of less than 14.3 cubic feet per acre. Arable land, gardens and building areas occupy 12.6 per cent of Sweden's land area, bogs 14.3 per cent, ground above the coniferous timberline (fjeld) 13.9 per cent, rock outcrops, roads and other unproductive land 2.7 per cent of the land area. The total productive forest land is composed of 96 per cent forest land proper and of only 4 per cent pastured forest land. Of the total productive forest land 8 per cent is bare and 8 per cent consists of forest ground in need of drainage in order to reach maximum producing capacity.

The greater part of Sweden's productive forest land is covered with coniferous forests of pine and spruce. Only in some of the southernmost provinces are the broadleaf forests, consisting of birch, beech, oak and ash, etc., predominant.

The average yearly wood producing capacity of productive forest land with up-to-date management varies from 38.6 cubic feet per acre in northern Sweden to 57.1 cubic feet in southern Sweden. The average for the whole country is 45.7 cubic feet per acre.

The producing capacity, however, is not utilized to more than two-thirds of maximum. According to Swedish ideas, the area of bare productive forest land is rather extensive, comprising 4.44 million acres (8 per cent), but intensive work is going on in order to afforest these areas. Even earlier the Government appropriated substantial sums of money for this undertaking, but now the appropriations will be increased. To begin with a 15-year plan for reforesting private forest land, which prior to 1905 had been devastated, is being followed. The cost is estimated at 17 million dollars, the Government contributing one-half, a respectable sum for a country with a population of only six million. From 1905 on, mismanagement and devastation of the forests was arrested by a general forest law. Besides these sums considerable contributions have been voted for other forestry needs. The Swedish government thus shows that it fully realizes the important part forestry plays in Sweden. At present the belief is widely spread that the world's supply of merchantable conifers is rapidly being exhausted. It surely would be fortunate for universal management, if the same up-to-date forestry data were obtainable from all countries as is now available in regard to forest conditions in Fenno-Scandia.

In Sweden there are 10,348 million trees of at least 4 inches diameter outside bark at breast height (4.25 feet from the ground). Per acre of produc-

[1]By way of comparison it may be stated that the forest area of Sweden is about 12 per cent of the forest area of the United States or somewhat larger than the forest area of the Lake States.

tive forest land the number is 172 with 36 of at least 8 inches, d. b. h., trees, *i. e.*, timber-trees. The total volume of wood in the forests of Sweden amounts to 50,062 million cubic feet, peeled volume, which corresponds to an average cubic volume per acre of productive forest land of 844 cubic feet, exclusive of bark. The timber supply consists of 40 per cent pine, 42 per cent spruce and 18 per cent broadleaf trees. If the bark is included, the figures should be raised by 20 per cent. The annual wood increment amounts to 1,683 million cubic feet, exclusive of bark. The annual growth consists of 38 per cent pine, 42 per cent spruce and 20 per cent broadleaf trees. The average annual increment per acre of productive forest land is 28 cubic feet. The best increment occurs in some of the provinces of central Sweden, where the growth amounts to 49 cubic feet per acre. The average volume increment per cent of all coniferous trees is 3.25 per cent and 3.90 per cent for broadleaf trees 2 inches, d. b. h., and up. Broadleaf trees less than 2 inches outside bark at breast height were not included in the survey.

If the bark-volume is included, the total timber supply will amount to about 60,000 million cubic feet and the annual increment to about 2,000 million cubic feet. The annual increment was found to be 850 million cubic feet more than even the boldest earlier estimate. The National Forest Survey, however, also showed that Sweden's forest ground is able to produce still more wood, but then, forestry management must be still more improved. In Sweden steady progress is being made in improving the shortcomings of forestry. The area that was the subject of the trial survey in 1911, the province of Värmland, showed upon being re-surveyed in 1929 considerable improvement in the conditions of its forests, with a substantial increase in both cubic volume and annual growth.

In the survey, the actual investigated or cruised area was 0.14 per cent of the country's total land area. The calculations made to ascertain the reliability of the results showed that the sample method adopted for the purposes of the National Forest Survey reaches a high standard of accuracy. It may be safely claimed that the results for the entire country in regard both to area of productive forest land and to cubic volume and increment, in a degree of probability bordering on certainty, cannot show at most more than 2 percent divergence from the results one would have obtained had the entire country been covered with survey strips 33 feet (10 meters) wide and the same methods of procedure been used.

The results, quoted here, are only a few of all those obtained in the survey. Figures are given not only for the different provinces but also for various areas at different elevations and for watersheds. The last-mentioned fact is of special importance for the big cellulose and lumber industries situated, as a rule, at the mouths of the rivers to which the timber is transported almost exclusively by river-floating. By means of the survey these industries now have a valuable and exact statement of the resources of their purchasing areas. The Survey figures are available by watersheds of the principle stream.

The National Swedish Forest Survey, the main results of which, as mentioned,

are already available, intends to publish a comprehensive and detailed final report which will appear in 1931 or 1932. In the near future the plan is to compile special statistics of timber consumption for the whole country. Then the Swedes will be perfectly certain regarding both the debit and credit sides of the balance sheet of their forests.

The total expenses for the survey are estimated to amount to about $375,000 (1,400,000 Swedish Crowns), of which one-third was for the compilation. The total cost corresponds to 0.37 cents per acre of land area or 0.65 cents per acre of productive forest land, a low cost for such a far-reaching and detailed investigation.

Recently, a short preliminary report[2] of the main results has been published also in English. This may be obtained by interested persons upon application to Riksskogstaxeringsnämnden, Stockholm.

[2]The introductory pages of this report were reprinted in the March, 1931, issue of the JOURNAL OF FORESTRY.—*Ed.*

REVIEWS

A Soil Study of the Mont Alto State Forest. By John T. Auten. *Research Bul. No. 4, 64 p. Department of Forests and Waters, Harrisburg, Pennsylvania. 1930.*

In this bulletin of sixty-four pages, illustrated with many plates and figures, and a bibliography containing eighty-one titles the author has made what seems to be a very exhaustive study of the soils of the Mont Alto State Forest in Pennsylvania. The literature bearing upon forest soils is quite extensively reviewed, but little effort is made to analyze or evaluate the work of the authors cited.

The thesis of the bulletin is the correlation of the soil on ridge, slope and cove with the growth of the trees in those three locations. To this end, over a hundred soil samples were collected from the different horizons in all three types.

These samples were analyzed to determine the amount of nitrogen in the soil in the form of nitrates, the amounts used by the forest and that carried off in the drainage waters. The same was done for calcium and phosphorus. The acidity of the soil in the three sites was determined, and mechanical analyses made. Moisture determinations were made in the peaty layer which composed horizon B.

The size, number and weight of the leaves, as well as a chemical analysis, were determined for each location for the average trees and the average acre. The author shows that there were 3,000 pounds of dry oak leaves produced in the ridge type per acre per year, 3,600 pounds on the slope, and 5,500 pounds in the cove. The area of leaf surface (considering one side of leaf only) was 216,000 square feet per acre of ridge, 248,000 square feet on the slope, and 256,000 square feet in the cove. These leaves produced per acre on the three types, of nitrogen, 57, 68 and 112 pounds, respectively, of phosphorus, 5.15, 4.49 and 5.78 pounds, and of calcium 22.8, 20.2 and 23.65 pounds. The production of wood per acre was carefully studied.

The production of both leaves and wood was found to be much greater in the cove than on the ridge. The slope was midway between the other two types in almost everything.

The peaty layer of humus in horizon B was much thicker in the cove and the leached layer below it more distinct. The acidity of the soil was highest in the coves and decreased toward the ridge. The total nitrogen content of the three types was much the same, but both calcium and phosphorus were more plentiful on the ridge than in the cove.

The physical make-up of the soils on the three types did not differ essentially,

but the moisture was much greater in the coves.

A number of fertilizers applied to plots in the nursery failed to increase the height of the seedlings. Whether or not the weight of the seedlings was affected is not stated.

The bulletin represents a tremendous amount of work and contains some very interesting data. The conclusions, however, are not entirely convincing, and the lack of proper headings for the tables and figures, together with the very intricate code of symbols used in them, make them very difficult to follow.

The author comes to the conclusion that the greater growth on the cove types is very largely due to the higher water content of the soil.

E. G. CHEYNEY,
University of Minnesota.

Forestry in Denuded China. By W. C. Lowdermilk, *California Forest Experiment Station,* assisted by Teh-i Li, *Fellow in Forestry, University of California, Berkeley, Calif. The Annals. Am. Acad. Pol. and Soc. Sci., Philadelphia. Nov. 1930, pp. 127-141.*

The paper sketches general facts underlying the utilization of lands formerly occupied by forests in China, methods of providing a future forest supply, means of controlling accelerated erosion and of conserving rainfall.

The forestry problem of China comprises many specific problems which are influenced by locality, soil, topography, climate, transportation, and density of population. The forest cover has been destroyed on such a scale that the primitive high forests remain in only three regions where extensive exploitation is possible for export to other parts of the nation. The forests in northwest Mongolia, however, are extensive and as yet untouched, and may in future contribute important wood supplies to northwest provinces. Extensive utilization of forests has followed periods of rebellion and disorder. Burning of elevated lands to drive out wolves, leopards, and tigers has destroyed much timber in China, especially where agriculture has advanced on the forest. This in turn has increased erosion. Fire has been used in clearing the lands.

Principles of sound forest management are generally found in temple forests. A sustained annual revenue is derived from construction material and fuel cut from these forests, in addition to the needs of the temples for repairs and fuel. The temple forests occur more or less throughout China. In many localities soil fertility is low because of the close utilization of all vegetable materials. Wood and grass, including stems and roots, are used in many regions instead of coal, the vegetation being annually raked up leaving the ground exposed. This practice has had disastrous effects on soil fertility and the percolation of water through the soil. This in part accounts for the shifting cultivation typical of many localities. And yet the transportation of commodities, packed as they are on men's shoulders, in wheel barrows and carts, or on mules' backs, makes the

resident population dependent on the products of the soil near at hand.

The author considers the forests of China as of three major divisions, which coincide with river drainages—namely, South China, Central China, and North China.

South China embraces the area south of the Yangtze Basin, including commercial timber areas of considerable value. It is mountainous, but includes restricted river valleys. The climate is tropical, with long, warm to hot and wet summers, and cool, dry winters. Erosion of relatively less seriousness has occurred in the interior regions. Here the major forestry problem comprises the formulation of a system of management of the mountainous areas. Planting is necessary only for the production of softwood timber.

Central China is an area of varied conditions. The topography ranges from wild, inaccessible recesses, to marshy overflow plains of the deltas. The climate is mild, moist, and warm to hot in summer, and of slightly freezing temperatures in winter. On drained lands the tree growth consists of an association of *Quercus-Liquidambar-Cunninghamia*—bamboo. Flood famines have frequently caused migrations into the mountains.

North China brings into consideration most forestry problems in Manchuria. The forests here are being rapidly exploited, chiefly as "timber mines." In the great delta plain of the Yellow River much timber is produced and exploited. The mountains of Shantung are barren and subject to heavy erosion. Each winter the poor of the villages gather the grass from the hills, digging up the roots for fuel. The fuel demand is so great that young planted trees are also removed. The forestry problem is most critical in North China, a region of serious famines. Although the shortage of timber is pressing, the real problem is the serious erosion on cultivated slopes. The investigations in Shansi and Shantung indicate that the exposure of the slopes due to cultivation has increased surface run-off fifty-fold, and the rate of erosion several thousand-fold.

Erosion control in China involves a consideration of the establishment of a base level of cutting in drainage channels, by construction of check dams, and the covering of the slopes with any vegetation that can be established. This broad procedure is calling into play various modern forestry methods and at least some control of erosion.

ARTHUR W. SAMPSON,
University of California.

Tyotieteellisia tutkimuksia metsatyosta. I. Penopuunteko (Studies on Efficiency of Labor in Forest Work. I. Preparation of Piled Wood). By I. Lassila. *Acta Forestalia Fennica. Vol. 36, pp. 1-88, 1930.*

A lengthy English summary will permit foresters without a knowledge of Finnish to profit by the methods used, and the analysis made, in this interesting study of elasped time from the stump to the skidway.

To bring rationalization into the for-

est, the woods work must be analyzed. Woods work requires both physical and mental effort at the same time, although the latter is considered of greatest importance. Unlike most industrial processes, the motions in woods work do not necessarily follow one another in the same sequence, and the highest efficiency is often dependent upon the capacity to devise rapidly the proper sequence of motions. The lack of absolute uniformity in forest products and in the terrain injects into woods operations elements incapable of timing. These untimable elements of work prevent strictly accurate comparisons between the efficiency of two laborers.

Two types of time studies were undertaken, group studies, those measuring the total elapsed time as divided between effective and ineffective time for the entire operation from felling to piling, and piece work studies, those attempting to find out the time required by each motion. The latter studies require a degree of fineness that we in this country probably do not as yet appreciate.

It was found that an area unit of wood in trees above 14 to 16 cm. could be sawn in quicker time than such a unit in trees of that diameter. Many readers will probably question the finding that the time to lop tops of pine and spruce varying in length from 3 to 6 meters remains the same, although it is admitted that more physical force is required for the larger crowns.

The factors constituting allowance time are given as personal allowance, unavoidable delays, delays due to the special character and special conditions of a piece of work, and delays due to fatigue. Especially in forestry work the determination of the necessary pauses for rest requires much practical experience and judgment. Limited investigations indicate that in the sawing of large logs every 10 minute working spell must be succeeded by 2 minute rests and that even better results are obtained by such a rest period after every 5 minutes of work.

P. A. Herbert,
U. S. Forest Taxation Inquiry, New Haven, Conn.

Ueber den Einfluss verschiedener Waldbestande auf den Gehalt und die Bildung von Nitraten in Waldboden. (Influence of Different Forest Types upon the Content and Formation of Nitrates in Forest Soil.) By A. Nemec and K. Kvapil. *Zeitschrift für Forst und Jagdwesen, No. 6 and 7, 1927.*

The authors studied the nitrate content in the soils of different forest types of Bohemia and Moravia. The principal conclusions derived from the study are as follows:

The nitrate content of forest soils varies with the depth of the soil; the upper litter and mold horizons are in general richest in nitrates. In different soils the content of nitrates depends, however, upon composition of the main stand, ground-cover vegetation, conditions of light, reactions of soil layers, and the like.

Strongly acid humus layers of coni-

ferous forests with no ground vegetation have commonly a tendency to denitrification. Less acid humus layers of soils with no ground-cover vegetation or with some mosses (*Hylocomium, Hypnum, Dicranum, Polytrichum*) do not show any denitrification processes, but neither are the nitrates forming in such soils. The coniferous stands with a rich association of ground-cover plants and shrubs show a considerable nitrification ability. Especially very intensive formation of nitrates was observed in forest stands with *Rubus idaeus* and *Rubus nemorosus;* both of these plants seem to be entirely nitratophylic species.

The removing of coniferous (Norway spruce) stands is associated with a pronounced increase of nitrification ability of humus layers. This phenomenon is directly connected with the appearance of typical vegetation of cut-over areas (*Rubus idaeus, Epilobium angustifolium, Galeopsis spinosa, Mercurialis perennis,* etc.). Furthermore the process of nitrate formation becomes essentially progressive under the influence of direct sun rays.

In the beech and other hardwood forests with no ground-cover vegetation or with mosses there is no nitrification. If the acidity of soil is high, there is a tendency to denitrification. In hardwood forests with ground-cover vegetation the intensity of nitrification is connected with the floristic type of forest. The organic layers of "Oxalis" type in beech stands show the nitrification ability smaller than that of stands with *Asperula odorata, Anemone hepatica, Mercureàlis perennis, Epilobium angustifolium, Paris quadrifolia,* and *Rubus idaeus.*

The soil of mixed coniferous-hardwood stands shows higher nitrification than does the soil of pure stands of coniferous and hardwoods. The nitrification in mixed stands is favorable even in the cases when the dense growth of the main stand obstructs the access of light and the development of ground vegetation.

The work is written in readable German and besides the record of analyses, it includes a general outline of the problem. The literature cited includes nearly a complete bibliography on the subject.

S. A. Wilde,
Lake States Forest Experiment Station.

Forsvaltningskostnader pr. har. (Administration costs per hectare). By Seth Grönkvist. *Skogen. Vol. 16, No. 8, pp. 229-230, April 15, 1929.*

Presumably in analogy with common terms in forestry such as volume per acre, increment per acre, etc. the conception of administration costs has arisen, won acceptance and now begins to be more or less indiscriminately applied in operating calculations, valuations and similar computations.

While the first two expressions are fully correct and give exact figures, the latter, on the contrary,—administration costs per acre—is to a high degree meaningless, so that its use often leads to absurdities I shall show by some examples below.

Administration costs can be said, at least in a narrow sense, to be annual

charges expended for the care and use of a certain capital, in this case soil and the forest growing upon it. Of this capital the soil value makes up only a small part as a rule, while the chief value of the object of management consists of the forest growing stock. This, in itself, suggests that it must be misleading when one puts management costs which refer to the whole capital in proportion to only a small part of it. Now since one acre of forest land can vary from a fraction of a dollar to several hundred, such a method of expression leaves one quite up in the air.

What expenses for management which can or ought to be incurred must always be dependent on value. Areas of worthless land, however great, can never bear any costs whatever for management.

That this is unfamiliar I shall not insist upon. If one turns to the Forest Service administration he finds at once that the area plays a slight rôle when the administration costs for supervisory districts in interior Lapland with low values per acre amount to a fraction of a cent to a few cents, while on forests in southern Sweden they amount to a dollar or more per acre. Yet it may be questioned if, in the latter case the management costs do not appear to show up as especially high just because of this method of expression.

It is also, I believe, a quite common belief in the government Forest Service that, at least a few years ago, it was easier to get an increase in the personnel, assistants and rangers, in Norrland than in the southern part of the country.

This method of showing administration costs is completely misleading when the figures are later used, for example in valuations which precede the purchase of forest tracts.

In the government's valuation surveys, after a property's gross value, the sum of the soil value, value of timber and the value for other possible uses, has been estimated, a deduction is made of, among other things, a capital obtained through capitalizing the computed annual costs of Administration according to a definite interest rate. These in turn are obtained by multiplying the area in question by the *average cost of administration per acre,* which is in force on surrounding forests or districts.

If this amounts, for example, to $1.10 for a certain tract, it follows that, using 4 per cent, a capital of $11.00 per acre for administration expenses will be included under the debit items against the land. If further, the forest land of the property offered for sale consists on the average of site-quality IV, which, it is considered ought to represent a value of $6.50 per acre, then therefore the seller finds he has to pay out $4.50 for every acre he wants to get rid of; although this perhaps does not become apparent, as only the value of the timber and other resources are reduced in this way. If this method of applying administration costs per unit of area be strictly applied, then really bare land, which is neither especially good nor well situated never can have any plus value in regions where the administration costs figured per acre are high. I know a case where alternately a certain part of a lot, and the whole lot were offered for sale. In the valuation sur-

veys which were made the part of the lot was actually given the highest value because of the fact that the remainder consisted chiefly of cut-over land.

Since thus the method of regarding the costs of administration only in relation to the area tells us nothing and besides leads to incorrect calculations, when applied blindly, it would seem that it should be done away with completely.

In order to get a correct relative expression for the value of costs of administration I cannot conceive of any method which is more obvious than to express them in relation to the value they represent, and thus evolve a certain administration cost per cent, for example, for each forest district. The sum of the estimated values for the district could then be used. Since, however, in calculating these values, the capitalized administration costs have already been deducted, one would not get an administration cost per cent which could be applied directly to the gross value in valuations. Neither would a comparison between the administration cost per cents of different districts be correct, for the same reason.

It ought to be better, therefore to apply the gross value of an administrative district, the sum of the values of the forest soil, timber and other uses. If common bases are used as the foundations for such a calculation they ought to be at least as uniform as in assigning the estimated value. The area of forest land of different site qualities is always known, as well as fairly accurately the stand of timber and its composition. It is a question only of fixing what average sale values should be assigned. The relation between the annual costs of administration and the gross value; expressed in 100ths will express the administration cost per cent.

This per cent would be of great interest to investigate, for instance, for different districts on the national forests. In this way one would get a correct basis for deciding the amount of administration costs. It is not impossible that in places where they are now considered high, they are actually lowest.

If one wants to get as near the truth as possible these calculations should then be supplemented by more detailed analyses. Docent L. Mattson Mårn, advocated this in a paper (Skogen 14 (18) :414-415, 1927). Thus he pointed out that many costs, which now are charged to supervision, in many cases are pure logging costs and ought to be charged to the stumpage cut.

If we suppose that the average for the administration cost per cents of all the districts might be 1 per cent then certainly, the districts whose per cents departed farthest from the average, ought to be investigated. In a district showing a per cent of, for instance, 2 per cent should not a large part of the costs be attributed to manufacturing costs (sawmill in the district), and ought not reductions to reduce operating costs be made? On the other hand the intensity of management on districts with very low per cents must be investigated. The capital which these districts represent is perhaps not receiving the care which it should; the personnel is possibly too small here. To get an indication in this way of where supervision costs are especially low would be of no

little value, and the discoveries, which might be the consequence of this would certainly not come too early.

In *valuations* a knowledge of the current average administration cost per cent would be of great value, since it could be applied directly to the gross value. Thereby one would have a correct basis for the large debit item which the compounded value of supervision amounts to. Some may possibly object that by this method, the above value will be figured too low where the purchase consists chiefly of bare land or severely-cut forests where much work will be required to return them in a fully stocked condition. This will hardly be the case, however, since while such forests will certainly require much attention during the first years, they will take care of themselves during a following long period of years.

Translated by,
H. I. Baldwin,
Brown Co., Berlin, N. H.

Observations on the Winter Snow Cover in the Vicinity of Talitski. By W. Th. Ovsiannikoff. *(French Resumè) Government of Perm.*

In the vicinity of Talitski, the covering of snow begins to form between the 18th of October and the 13th of December and to disappear between the 29th of March and the 28th of April. The maximum thickness of the cover was observed from the end of February to the first of March. The first fall of snow was observed the 24th of September; the latest the first of June.

All forms of forest have an immense influence on the accumulation and the conservation of the winter precipitation. In the old, dense forests, the snow forms a carpet of even depth and lasts 10 to 30 days longer than on the open spaces. The small, open forests, the thickets, the screen and the brush retain the snow in the form of drifts, of which the melting begins from 10 to 20 days later than in the open field. On the open fields the snow forms an irregular cover, undulating and of minimum thickness. The first places where it disappears are the fallow, southern slopes of vast open spaces.

In the continental climate of the Transural country, the forest is of very great importance: it modifies the winds, humidifies the air in conserving the run-off of winter precipitation, it saves the country from the deadly drouths of spring time.

E. G. Cheyney,
University of Minnesota.

Compression Wood (Om Tennar). By Elias Mork. *Grödahl & Söns Boktrykkeri, Oslo, Norway, 1928.*

As a result of work on spruce (*Picea excelsa*) the author advances the theory that the so-called compression wood, which frequently occurs in leaning stems or on the under side of large branches of coniferous trees, is the means by which the tree carries out geotropical growth movements. That is, the real function of compression wood is to force the leaning trunk back to a normal or upright position again.

If the tree has assumed a position such that the geotropical demands are not satisfied, irritation of the cambium follows, and the formation of the cells characteristic of compression wood results. While no theory of the mechanism of the irritation referred to is advanced, the author evidently does not subscribe to the view that compression of the cambium cells or the influence of gravity on sap flow are primary causes of it.

The occasional occurrence of compression wood in straight, concentric trunks, may be explained, in some cases at least, as follows: Where a tree is exposed to the stress of the prevailing wind, compression wood may be formed on the leeward side and may exert sufficient force to bend the trunk in the opposite direction somewhat further than the normal or vertical position. This induces the formation of compression wood on the side towards the wind, to counteract the effect referred to, as a result of which the trunk may again be forced into an abnormal position. Thus the trunk successively assumes different abnormal positions, and each time it does so, irritation of the cambium to form compression wood cells, whose office is to correct the abnormality of position, follows. As a result of this process the compression wood disposes itself in a spiral which must necessarily be continued if the tree is to be kept in a position conforming to the geotropical demands. This idea of the real function of compression wood is a most interesting one but unfortunately the author does not support it by any convincing evidence and it is therefore a theory only.

In discussing the relationship between per cent of summer wood in the ring and tracheid length the author distinguishes summer wood as that in which the wall between adjoining lumen (measured in a radial direction) multiplied by two is equal to or greater than all the lumen, and spring wood as that in which the width of the wall is smaller than that of the lumen.

In vigorously growing trees it was found that while tracheid length increased from the pith to the bark (the tracheids close to the pith being about half the length of those near the bark), the width of the individual ring had an important influence on the length of the elements. If the rings increase very markedly in width the length of the tracheids decreases. This is ascribed to the fact that the greater the rate of growth (*i. e.*, the wider the ring) the more often must transverse division take place in the cambium cells to form new cambium cells. Consequently the interval for growth in length of the cambium initials become shorter as rate of growth increases, and this results in shorter derivations.

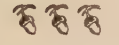
In common with other investigators, the author found the tracheids in compression wood to be shorter than those of normal wood.

Resin canals were found to be neither larger nor more numerous in compression wood than in normal wood. The amount of resin was, however, found to increase with greater rapidity of growth.

Logs containing compression wood are undesirable for pulping by either the chemical or mechanical processes. The higher lignin content and shorter fibers of compression wood result in difficulty in cooking and in an inferior

quality of pulp, in the sulphite process. In grinding for the production of mechanical pulp, compression wood is reduced to flour and the yield and quality of the product is correspondingly lowered.

BIRGER BERG,
University of Michigan.



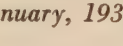
The Conifers of the Italian Mountains (Le Conifere della Montagna Italiana). *L'Alpe, Vol. 18, No. 1. January, 1931.*

The January number of *L'Alpe*, the monthly journal of the Touring Club Italiano of Milan, Italy is a special number devoted to the conifers of the Italian mountains. It is a semi-technical contribution of real dendrological value to the forester interested in the trees of the region, and, since the same species cover practically the entire commercial tree flora of Europe, it has much wider than local value. Nine authors contributed 13 articles totaling 96 pages.

A brief opening article describes the forested mountain region and the forest industries. This is followed by an article on the classification of the species, with a key. Then follow descriptive articles, each pertaining to a single species. There are over 100 half tones and diagrams picturing the foliage, fruit, natural habitat, and gross characters of the species. The photographs themselves are remarkably clear and well selected — "magnificently illustrated" would be no exaggeration. There are a number of drawings of cones, scales and other parts to emphasize distinguishing characteristics. The species described are *Pinus cembra, P. nigra, (laricio), P. heldreichii, P. silvestris, P. mugo, Larix decidua, Picea excelsa, Abies alba, Juniperus communis,* and *Taxus baccata.*

L'Alpe, although published by a touring club, is a journal devoted to the forest, and each issue contains very interesting articles on forests, stream flow, erosion control and related topics.

EMANUEL FRITZ,
University of California.



The Social Management of American Forests. By Robert Marshall. *League for Industrial Democracy, New York, 10 cents.*

This little booklet contains a very clear statement of the case for public regulation by the federal government of private forest land in the United States. It is written for the general reader, and begins with a brief account of the character of the forest resource and its relation to modern civilization. While the importance of forests as sources of raw material is not overlooked, the emphasis is placed upon their indirect contribution to public welfare. The history of private management of forest land is sketched very briefly, and is followed by a chapter which points out the most commonly recognized obstacles to private forestry. The story of the national forests is touched upon, contrasting the merits of public operation with the failure of private management of forest land. Up to the last chapter, the entire booklet

appears to be an argument for public ownership of forests. Here the author discloses his opinion that "it is extremely unlikely that socialization of forest land will be undertaken on a large scale for years to come". The Clarke-McNary policy of stimulating private forestry by coöperation between public and private agencies is discussed unfavorably, and the possibilities of private timber monopoly or of regulation of forest land by the several states are briefly dismissed. Federal regulation is advocated as the most feasible and immediate remedy for the forestry situation, and some suggestions are made for its application. Constitutional objections are mentioned, but the impression is given that these may be overcome. Certain additional steps are proposed, including the modification of the Sherman Act, public control of funds for fire protection, and control of insects, and expansion of publicly owned recreational forests. The ultimate conclusion in the author's own words is as follows: "Unfortunately, however, public opinion is so conservative that before socialization can be carried out most of the forest lands will be devastated or at least their productivity will be seriously depleted. Consequently, until public ownership of the large tracts of timberland is possible some form of federal regulation must be exerted to stop private forest devastation".

The style of this booklet is refreshingly clear and the subject matter is presented in an interesting and logical manner. There is no assumption of moral superiority. A single reference to lumber operators as "private marauders" seems to have been a slip, for it is distinctly out of harmony with the general dispassionate tone. Because of the necessity of covering so large a subject in so short a space, it has been necessary to assume most of the economic foundations of the argument. It would be interesting to know why the over production of lumber is ascribed so largely to high taxation and the effect of other carrying charges not mentioned, when taxes at most range from 1 to 2 per cent, as against at least 7 per cent a year for the interest and administrative costs of carrying standing timber.

The adequacy of the comparison between public and private forest management in the United States might be questioned. How can such a comparison be significant with no consideration of the economic benefits from the raw materials provided, or of costs and returns? Would it not be more illuminating as well as far more favorable to private ownership to select a region which enjoys adequate fire protection and reasonable taxation, such as the forest district of Maine, for comparison not only as to present condition of the forest but as to the economic value of the yield, with one of the most productive groups of national forest lands of about the same area? Also, it seems hardly convincing to predicate the probable constitutionality of federal control of private forest land on brief extracts from Supreme Court decisions taken apart from their context. One hardly knows but what the suggestion that transpiration of water vapor renders private trees

subject to federal regulation might be a bit of subtle humor, but it seems to be seriously intended.

On the whole the author has done the profession of forestry a real service by writing this booklet. He has removed the case for federal regulation from the fog of fine phrases with which it has been obscured, and has shown it clearly for what it really is; a case for public ownership of forest land. The only reason for preferring federal regulation of private forest land to public ownership, as so well brought out in this publication, is the opinion held by the author that public sentiment is less resistant to federal regulation than to public ownership. With this opinion few will agree, as forest acquisition and ownership is already an established policy of the federal and of many state governments.

R. C. Hall,
Forest Taxation Inquiry,
New Haven, Conn.

BRIEFER ARTICLES AND NOTES

The Variance of Western Yellow Pine Crown Lengths or Widths and Stand Density

It has been found in a study of slash disposal on the Colorado Plateau[1] that the amount or volume of brush debris originating from the tops of felled trees varies with the merchantable volume of western yellow pine stands.

As volume per acre increases the amount of brush debris decreases per thousand board feet.

In connection with this study, fifty-

Table 1

THE RELATION BETWEEN STAND VOLUME OF WESTERN YELLOW PINE (ARIZONA) AND CROWN WIDTH OR LENGTH

Volume per acre Board feet	Crown width Feet	Crown length Feet	Per cent crown length of total tree length	Per cent crown width of total tree length
100	27.8	28.5	84.5	54.9
500	27.4	29.4	83.5	53.5
1,000	27.1	30.3	82.9	52.0
2,000	26.5	32.1	81.2	50.4
3,000	25.9	33.8	79.8	48.7
4,000	25.3	35.6	78.1	47.0
5,000	24.7	37.2	76.6	54.1
6,000	24.2	38.4	75.0	43.4
7,000	23.7	40.3	73.6	41.7
8,000	23.3	41.8	72.2	40.0
9,000	23.0	43.2	71.0	38.2
10,000	22.7	44.5	69.9	36.9
11,000	22.4	45.8	69.0	35.3
12,000	22.2	46.9	68.1	34.0
13,000	22.1	48.1	67.2	32.9
14,000	21.9	49.2	66.6	31.7
15,000	21.8	50.3	66.0	30.6
16,000	21.7	51.3	65.8	29.8
17,000	21.7	52.3	65.5	29.0
18,000	21.6	53.2	65.4	28.1
19,000	21.6	54.1	65.4	27.6
20,000	21.6	55.0	65.4	27.0
21,000	21.6	56.0	65.9	26.5
22,000	21.6	56.8	65.4	26.0
23,000	21.6	57.7	65.4	25.9
24,000	21.5	58.5	65.4	25.5
25,000	21.5	59.3	65.4	25.3
26,000	21.5	60.2	65.4	25.1
27,000	21.5	61.0	65.4	25.0
28,000	21.5	61.8	64.4	25.0
29,000	21.5	62.6	65.4	25.0
30,000	21.5	63.4	65.4	25.0

Average deviation of crown width from interpolated values $\pm$ 1.63 of crown length $\pm$ 9.08.

[1]McIntyre, A. C., Brush Disposal in the Western Yellow Pine Type of the Southwest, Unpublished Manuscript. U. S. Forest Service.

four sample plots were layed out and crown widths and lengths of all trees over six inches d. b. h. were secured. The plots varied from two and a half to ten acres in size and were selected on a basis of tree distribution. Only areas that appeared to be normally stocked were selected, excepting four plots which were layed out in very open stands found at low elevations on the edge of the type. Here crown width was about the same as crown length.

The accompanying table shows the variance in crown length or width as stand volume increases, and percentage relationship between crown length or width and average total height of trees.

The deviation of the crown widths was less than two and a half times the standard deviation (S. D.±1.36). Three plots with average crown length more than three times the standard deviation (S. D.±4.93) were rejected.

The data were plotted and average curves drawn, from which the data in the table were read.

It has been suggested by Chapman[2] that crown width might be used as a criterion of yield.

That a correlation exists is apparent but for western yellow pine crown length would prove the better index. Table 1.

A. C. McIntyre,
Pennsylvania State College.

[2]Chapman, H. H., Forest Mensuration; John Wiley & Sons, 1921, p. 423.

Comparative Rates of Growth Per Acre of Southern Pine and Douglas Fir[1]
Site Class: 70 feet in height at 50 years

Age In years	Loblolly Table 38 (Cu. ft.)	Longleaf Table 70 (Cu. ft.)	Shortleaf Table 102 (Cu. ft.)	Slash Pine Table 134 (Cu. ft.)	Douglas Fir Wash. & Ore. Table 2 (Cu. ft.)	Douglas Fir California Table 7 (Interpolated) (Cu. ft)
20	2,300	2,000	2,120	3,250	730	———
30	3,400	3,000	3,900	4,250	1,930	———
40	4,450	3,950	5,290	5,000	3,020	3,650
50	5,200	4,800	6,300	5,650	4,080	5,025
60	5,700	5,600	7,030	6,100	5,010	6,200
70	6,000	6,200	7,600	———	5,820	7,125
80	6,250	6,800	8,030	———	6,530	7,875
90	———	7,200	8,400	———	7,120	8,475
100	———	7,600	8,660	———	7,620	8,950
110	———	———	———	———	8,050	9,350
120	———	———	———	———	8,410	9,675
130	———	———	———	———	8,720	9,925
140	———	———	———	———	9,020	10,225
150	———	———	———	———	9,280	10,400
160	———	———	———	———	9,500	10,550

[1]References:

Rate of Growth of Second-Growth Southern Pines in Full Stands. U. S. Dept. Agri. Circular 124, 1930.

Volume, Yield and Stand Tables for Second-Growth Southern Pines, U. S. Dept. Agri. Misc. Pub. 50. 1929 (Tables cited).

The Yield of Douglas Fir in the Pacific Northwest (Table cited). U. S. Dept. Agri. Tech. Bul. 201, 1930.

Yield, Stand and Volume Tables for Douglas Fir in California (Table cited). Univ. of Calif. Bul. 491, 1930.

A. B. Recknagel,
Cornell University.

Capital and Interest[1]

The article which follows is by the Hon. Nigel A. Orde-Powlett, and is reprinted from the *Quarterly Journal of Forestry*, London, October 1930. It is of interest because of its presentation of the compound interest fallacy:

In any business concern, that is to say, in any undertaking the object of which is to make a profit, it is necessary to have capital. Capital may consist of money invested in the business by the owners or by the public, it may consist of machinery, buildings, labour, railway trucks, etc.; or it may consist of brain power. Capital in fact, is a possession of any sort whatever which is utilised for the acquisition of wealth by the possessor. A man who, after years of study and expense, goes into practice as a doctor, is capitalising his brain in order that it may bring him in a reasonable rate of interest for the rest of his life. A furniture remover owns lorries and employs labour, and these constitute his capital, by means of which he carries out the work which produces his interest. Anyone who invests his money in stocks or shares does so with the expectation of receiving interest on his money annually. The brains of the doctor and the lorries of the furniture remover are capital in exactly the same way that the money of the investor is capital, since the income of the possessors is dependent on them, and their loss or withdrawal from business would result in a cessation of interest.

For a business to produce the highest possible financial return a proper realisation of what constitutes capital is essential. In the simplest case, that of money invested in stocks and shares, the position of capital is well defined and admits of no misunderstanding. The owner knows that his capital must remain intact until he reconverts it into cash, when it will cease to produce interest and in consequence ceases to be capital. If the furniture remover reduces the number of his employees or of his lorries below the minimum necessary for the execution and development of his business the reduction of capital will entail a reduction of interest. If the doctor applies his brain for a considerable part of each day to affairs unconnected with his practice he is withdrawing capital from his business and his income will be reduced. Capital of one sort or another in fact, is absolutely essential to the production of profit, and no business can be said to be well managed unless the capital invested in it is maintained at that precise level which will ensure the highest possible rate of interest. If too little capital is built into a business the greatest possible income cannot be returned and intensive development is impossible, while if a business is over capitalised the rate of interest is disproportionately small, and the surplus capital is idle and unproductive; furthermore, in those businesses where capital consists of material rather than actual money, over capitalisation may bring about a risk of bankruptcy during years of depression which would be safely tided over by a similar business that had not become unwieldy. In every business there is a limit as regards immediate expansion, and capital must be limited in proportion.

[1]This article was referred to in the March issue, but was inadvertently omitted.

It follows, therefore, that for the rational development of any business the paramount importance of capital must be realised and its nature understood. In the case of cash investments, as has already been stated, there can be no difficulty in determining what part of the business comprises capital. In concerns, however, whose capital consists wholly or partly of material other than money the comprehension of capital becomes infinitely more difficult, and in no other concern is it more difficult to understand than in forestry.

Forestry is as much a business as banking, shop keeping, or any other concern the object of which is profit making, for silviculture is, or should be, the cultivation of trees for profit. It is true that few British estates would show a profit on their woods if the average was taken on a number of years, but this is due to the fact that few owners make any serious attempt to run their woods on business lines. The ordinary British estate resembles, so far as its woodlands are concerned, an antique shop, the owner of which is himself a connoisseur and lover of *objets d'art*, and cannot bear to part with any of his stock; both woodlands and antique shop are run at a loss, but either might show a profit if organised on business principles. The owner, therefore, who intends to organize his woodlands on business lines must determine in the first place what will constitute the capital of his business. This determination is rendered unnecessarily difficult owing to the fact that estate woodlands are seldom managed as a separate and self-contained business undertaking, but are treated as an item in general estate accounts; money that is required for the payment of labour, purchase of trees, etc., is taken from the general account, while money realised by sales of timber or from other sources is paid into the general account, or even into the private account of the owner. If rational management is to be carried out with success the woodland business must be organised as an individual concern having its own books and bank account, and (for purposes of management) isolated from other activities on the estate. Without such isolation a true comprehension of the business is impossible, and the most intensive development cannot be attained. If, however, the woodlands are organised as a self-contained and individual business the determination of capital becomes comparatively simple.

The capital consists of: (a) The land under woodland, (b) Saw yard, plant, roads, timber wagons, horses, light railways, tools, and any improvements instituted for the successful extraction and marketing of the timber; (c) Labour; (d) Nursery, or purchase of young trees; (e) Wood capital; (f) The brains of the forester.

All of the above are capital inasmuch as they are necessary and instrumental in producing income from the forest. Furthermore, an excess or deficiency of any one of them will have an injurious effect on the net income. On most private estates (a)—the land under woodland, is more or less fixed and defined. It is usually quite apparent what acreage should be wooded, and we know that the whole of this area should be occupied by trees; (a), then, may be

taken as fixed capital which cannot be altered without drastic reorganisation of the scheme of management. (If hitherto unplanted areas are brought into the scheme the work becomes one of afforestation, and no such undertaking ought to be set on foot by private estates until existing woodlands have been developed, *i.e.*, at the end of the first rotation).

(b) Saw yard, plant, roads, etc. Little need be said on this subject since it is obvious that, if the arrangements for exploitation are under developed (*e.g.*, insufficient roads), the highest price will not be obtained for the forest produce, while, if they are over developed, the amount of money invested in them will not result in a proportionate increase of income.

(c) Labour. Is an item of forest capital which is very frequently over or under developed. The cause of this, however, lies in the fact that the woodlands are almost invariably treated as a mere part of the estate and not as a separate money-making concern. The woodmen are frequently taken off the woods at a time when they are most needed, and it is often difficult to ascertain just how much labour has been employed in the woods during any one year. It is admitted that, on a private estate, the labour should be transferable from one department to another, but if the woods were recognized as an individual concern and a definite number of men were employed by the woods as whole-time woodmen then they could be "hired out" to other departments *when not required in the woods* and *not* when required by other departments. If this method were practised it would be easy to determine what amount of labour capital was necessary.

(d) The nursery. Should be of a size adequate to provide the trees necessary in order to keep the woodland area fully stocked.

(e) Wood capital. This is by far the most important constituent of forest capital and that which is the most frequently neglected or misunderstood. It differs in some respects from any other form of capital, and is in consequence difficult of comprehension, but since it is the wood capital which must produce wood interest—the fundamental of forestry—a proper understanding of its nature is vital. If we regard each plantation or stand of trees on an estate as separate entities it is impossible to arrive at a true understanding of the meaning of the term wood capital; but if we are working the woods under a rational scheme of management, and consider every square yard of ground and every stick of timber as indissolubly associated with every other square yard and stick of timber for purposes of management, then the definitions of wood capital and wood interest become more easily understood. Take in the first place the case of a single tree. At the commencement of any year the tree consists of a certain bulk of timber contained in the trunk; during the growing season this bulk adds to itself by the addition of a sheath of new growth from top to bottom; the bulk at the beginning of the year, then, is the wood capital, and the new growth which is added is the wood interest for that particular year, the wood capital and wood interest being identical in nature to all other forms of capital and interest, this apply-

ing to every tree, of whatever age, over the whole woodland area. If we were to apply the ordinary rules of finance and reaped our interest, while leaving our capital intact we should have to strip the current year's growth from every tree on the estate, leaving the wood capital or bulk of the tree standing, but as this is an obvious impossibility some other method has to be adopted whereby the interest is secured without interference with the capital. Instead, therefore, of securing the individual interest from every individual tree, a number of trees are felled whose total volume is equal to the total wood interest of all the trees over the whole woodland area, and of every age. If, for example, it is ascertained that the annual increment of all the trees on the estate amounts in total to 5,000 cubic feet then that number of trees will be felled whose total cubic contents amounts to 5,000 cubic feet, and by this means the legitimate interest will be secured and the amount of the capital will remain intact although, theoretically speaking, we are neglecting to secure the real interest and are depleting the capital. The fact that the trees realised have passed their maximum rate of increment and are, therefore, comparatively speaking, capital lying idle, does not affect the theoretical question, though recognition of its necessity is essential for the maintenance of wood capital at its highest possible level.

This method of reaping the interest, produced by the annual increment of every tree on the estate, by the clear felling of an equivalent block of mature trees each year, is the only method practical in this country, and the necessity for it demonstrates a further point that is of the highest interest and importance when the question of woodland profit or loss is considered. This point is the inevitable and close relationship that must exist between the individual units, whether number of trees or area of ground, constituting any particular forest scheme with which we may be concerned; for it becomes clear that in making an annual felling we are, in reality, not so much felling the block of trees planted sixty, seventy, or a hundred years ago (whatever the length of rotation may be) as securing the interest from our whole wood capital and land capital over the whole woodland area. Each of the trees in our annual coupe, therefore, is virtually representing the interest from a definite acreage of ground on some other part of the estate. Thus, supposing on an estate containing 500 acres of woodland it had been ascertained that the mean annual increment was 10,000 cubic feet, or 20 cubic feet to the acre. Then, if our annual coupe for the year was an area of 8 acres, containing 1,000 trees averaging 10 cubic feet each, each tree is the interest representative of half an acre of land, and is as much the product of that half-acre for purposes of management and estimation as if it had been grown upon it. Indeed, it would be possible to picture certain circumstances under which the annual interest would be secured from isolated trees over the whole area, for it is only the administrative difficulties that would be entailed, and the impossibility of securing natural regeneration in this country, that necessitates the practice of clear felling. It is true that in countries where natural regeneration

is possible the interest is not secured from over the whole area, but the systems practised in such places approximate much more closely to the theoretical ideal, and the modifications that arise are due solely to considerations of regeneration and simplification of handling, and do not detract in any way from the truth of the principle.

This essential relationship between all parts of a forest is of the very highest importance when one is considering which of the innumerable methods for determining profit or loss should properly be adopted, for it would appear to render any question of compound interest unnecessary and misleading for practical purposes. For the exponents of compound interest consider each unit of the forest on its own merits; they take each plantation, its cost of establishment, ground rent, and any other charges, and say that the sum to which these amount must accumulate at compound interest until the trees attain maturity, when the money realised by their sale must attain the amount to which the sum has accumulated if a profit is to be secured at the rate of interest decided upon. But this method, and all associated methods, is accepting the mature timber as both capital and interest, and the money realised by its sale as the capital invested in the establishment of the crop together with the interest which has come into being and been added to it throughout all the years of the rotation. They are, in fact, mistaking for the capital invested in a few acres a great many years ago, what should be considered as income arising from the whole woodland area during the current year, and any conclusions founded on these premises are necessarily misleading. If it is accepted that the trees felled in any one year are, in actual fact, representative of the increment over the whole area, and that the money realised by their sale is the income from the land and growing stock, then the only logical method of determining profit and loss is to take the woodlands as a whole and make a comparison between the annual income and the annual expenditure; for, though it is perfectly true that a large part of the expenses are incurred by undertakings such as planting and establishment which cannot of themselves be expected to produce income during the current year, yet they are essentially undertakings that are incurred for the maintenance or enhancement of the productivity of the whole area. The thinking forester, in establishing a young plantation, does so not only to ensure that the particular piece of land that he is planting will produce a crop of trees in the distant future, but, far more, to ensure that the productivity of the woodlands as a whole will not be interfered with in a specific year in the future. He is attending to the efficient maintenance of his business and though, by the nature of forestry, his plantation will not in itself realise an immediate profit, yet it is putting on increment every year, and that increment (interest) will be realised every year by sales of timber in other parts of the estate. If we admit this fact—namely that the annual increment of every plantation, of whatever age, on the estate, is converted into cash annually, then no question of compound interest, or even simple interest, can arise, and the question of whether the woods are being run at a profit or at

a loss is answered by an examination of the income and expenditure for the year under consideration. Not only does this appear to be the logical method from the point of view of economics, but it is also the only method by which the owner can obtain a definite and accurate answer to the vital question of whether his woods are bringing him in a net income, or whether they are leaving him out of pocket.

The William H. Walker Forest and Wood-Using Industry

The impending submersion of several thousand acres of forest in central Massachusetts to provide flowage for the new Swift River reservoir has occasioned two recent articles on the forest of William H. Walker at Greenwich Village. One appeared in the November 8 issue of the *American Lumberman* by a representative of that magazine, and another in the December number of *American Forests and Forest Life* by A. C. Cline.

The Walker Forest with its permanent sawmill and wood-working shop has long been known among foresters as one of the few cases in the region where a long established wood-using industry has been backed by a sustained yield forest, and, withal, has made a handsome profit for the owner. The marked success of the enterprise has been due to a rare combination of conservative cutting in the woods, skilful sawing and finishing in the sawmill and finishing shop, and the selling of finished products only,—all under the direct supervision of one man. Mr. Walker was his own forester, millman, and salesman. He made every log count.

Starting about fifty years ago with a few hundred acres handed down by his father, Mr. Walker gradually built up the forest to its present size of 1,100 acres. Nearly one-half of the area is in white pine on the light soils of the Swift River valley, and the remainder is in mixed growth and hardwood on the heavier soils of the uplands. It is the handling of the pine stands which is of particular interest. Mr. Walker early learned about "thinning" from his father, and from the beginning has kept his pine stands well opened up and growing at a rapid rate. Actually many of his cuttings more nearly approached selective logging than thinning, but their purpose has always been increased growth rather than reproduction. Each stand was worked over every 10 to 15 years, and enough of the largest trees were removed to equal in volume what was considered to have been the amount grown since the previous cutting. Average annual growth per acre was estimated to be about 400 board feet, equivalent to a total of 200,000 board feet for the entire acreage in pine. Mr. Walker's thinnings would be considered heavy by most foresters, but they were purposely made so in order to prevent any appreciable slowing down in growth. But, effective as his cuttings were in increasing growth, the maintenance of the growing stock might well have been a failure had it not been for the fact that the pine was on pine land,—a light, sandy soil where hardwoods were both scanty and slow growing. Instead of filling up with hard-

woods, the openings made in logging came in to more pine. Unquestionably, the handling of the pine stands was greatly simplified by the permanency of the white pine type on the light soils.

But regardless of the low costs of silviculture the enterprise as a whole would never have borne fully matured fruit without the little, water-powered sawmill and finishing shop which stood near the center of the village, and which worked up the annual cut of logs from the forest, together with an equal amount hauled in by neighboring farmers,—all told about 400,000 board feet annually. Among its products were flooring, clapboards, door and window casings, woodwork for the Yankee horse rake, silo staves, chair stock, picker sticks, cloth boards, wagon and truck body stock, and general house finish. Nothing was sold "rough". By selling only finished products Mr. Walker obtained retail prices ranging from $40 to $75 per thousand board feet for material which, if sold in the rough at wholesale, would have brought only from $25 to $30. In one instance a single, unusually fine white ash tree yielded products totaling over $100. Mr. Walker admits that the great influx of cheap lumber from the West and South during the past decade has seriously affected his business, and that, furthermore, several items in his old line of products are no longer in demand. Whether a young man starting in now, where Mr. Walker is leaving off, could develop a new line and maintain the business at its old time level is open to question. There is little doubt, however, that just this sort of a set-up will in time again come into its own, but not until the East ceases to be a dumping ground for the "distress" lumber of other regions.

New England has had enough of the "cut-out-and-get-out" methods of the portable mill which has left in its wake untold thousands of acres of slash and "brush" which in most cases none other than the public treasury can possibly afford to rehabilitate. That vastly greater benefits are to be derived from forests kept continuously productive and from wood-using industries established for permanency, has always been the belief of foresters, but to date there have been few cases where such benefits have actually been demonstrated. The outstanding success of the Walker enterprise in commercial forestry has been a source of convincing proof which will be greatly missed.

A. C. Cline,
Harvard Forest, Petersham, Mass.

Timber Conservation Board Organizes and Starts Work

With the conservation of the timber resources of the United States as its principal objective, the National Timber Conservation Board, established in December by President Hoover, held its first meeting in Washington, January 7, setting up a working organization and outlining its general program. The Board met at the Department of Commerce, under the chairmanship of Robert P. Lamont, Secretary of Commerce.

The announcement of the selection of members of an advisory board, with R. Y. Stuart, U. S. Forester, as chairman, to assist in assembling data out of which a definite policy of conserving

the nation's forest resources may be formulated, and the appointment of Ripley Bowman, of the Department of Commerce, as administrative secretary, were made.

It was pointed out that chronic over-production is the chief obstacle to the preservation and conservation of the nation's timber resources. In view of this situation, the Board plans to compile the important facts of production conditions and trends in the forest industries, analyse and interpret them in order that such policies and programs of public and private action as will safeguard the public interest may be developed, leading to the perpetuation of the forests and stabilization of the industries based on the use of timber.

Among the specific topics which the Board plans to consider are included problems of taxation of timber and forest lands; sale and use of publicly owned timber, especially national forests, Indian timber reserves, and state forests; economic causes of the prevailing condition of over-production of forest products and consequent waste of timber, depletion of forest resources, and insecurity of employment in the forest industries; proposals to divert submarginal agricultural lands to commercial forest growing, and appraisal of relative importance of forestry projects.

Initial funds to finance the survey have been secured from private sources. It was announced at the meeting that the Board's headquarters will be in the Department of Commerce.

Members of the advisory committee as set up by the Board include E. T. Allen, Forest Economist, Western Forestry & Conservation Association, Portland, Oregon; Hugh P. Baker, Dean, New York State College of Forestry; Wilson Compton, Manager, National Lumber Manufacturers Association; William L. Cooper, Director, Bureau of Foreign and Domestic Commerce; S. T. Dana, Dean, School of Forestry, University of Michigan; Fred R. Fairchild, Professor of Economics, Yale University; Henry S. Graves, Dean, School of Forestry, Yale University; W. B. Greeley, Secretary-Manager, West Coast Lumberman's Association, Seattle; Charles T. Herty, Consulting Chemical Engineer, New York City; D. T. Mason, Consulting Forester, Portland, Oregon; George N. Ostrander, President, Finch, Pruyn and Co., Glens Falls, N. Y.; Charles James Rhoads, Commissioner of Indian Affairs; George W. Sisson, Jr., Director, American Forestry Association, Potsdam, N. Y.; R. Y. Stuart, U. S. Forester and Vice-Chairman of the National Committee on Wood Utilization, and J. W. Watzek, Jr., Crossett-Watzek-Gates, Inc., Chicago.

At its meeting on February 11, 1931, the Advisory Committee, by formal motion, adopted the following program for conducting the study "For the purpose of developing sound workable programs of private and public effort with a view to securing and maintaining an economic balance between production and consumption of forest products and to formulating and advancing a deliberate plan of forest conservation, that the following projects be undertaken with the aid of appropriate sub-committees":

1. Economic situation of forests and timber industries, including present and prospective timber supply; and present and prospective timber needs.

2. Privately owned timber, logging, manu-

facturing plants, and distributing facilities.
   a. Extent and character of timber ownership.
   b. Trends in timber values.
   c. Financial pressure for liquidation, esp. in West.
   d. Small mill situation, esp. in South.
   e. Producing capacities; operating efficiency; conditions of utilization.
3. Publicly owned timber.
   a. Extent and character of commercial timber under public ownership.
   b. Policies governing acquisition of timber and timber lands.
   c. Policies governing sale, cutting, and use.
   d. Revenues from national forests as timber conservation funds.
4. Economy, stabilization and diversification possible through centralized operations:
   a. In timber ownership, and production.
   b. In assembly and distribution of forest products.
5. Distribution and marketing methods; possibilities of diversification and expansion of markets and uses; and promulgation and/or methods of enforcement of standards for forest products.
6. Federal and state laws and policies in relation to timber conservation.
   a. Taxation.
   b. Other.
7. (a) Possible scope, method and form of continuing public and private coöperation for timber conservation, stabilization of industry and security of employment, including—
(b) Possible means of promoting economical perpetuation of forests and forest industries through sustained yield forest management, and otherwise.

Colorado
Evergreens Turn Deciduous

Foresters who would determine past drought periods by the width of growth rings in trees may find it difficult to distinguish between summer drought and winter killing injury if recent observations on the Pike National Forest in Colorado have any particular significance. Trees of Douglas fir and Engelmann spruce forty to sixty feet in height were so severely injured last winter as to cause the loss of all needles, leaving the appearance of a tree deadened by a light crown fire. Trees growing in groups or singly are at this time, November 1, 1930, entirely devoid of green needles. Trees without needles on one side but green and bright on the other, stand adjacent to one which pulled through the winter with practically all its leaves, while another is stark naked. Examination indicates that these trees, bleak and bald as a deciduous tree in winter, are still very much alive. Though no new growth was put on during the past summer season, the cambium is apparently bright and very much alive. Buds too, very much alive, are set and ready for a new start when the spring and summer season of 1931 approaches. The leaf buds which should have burst and made leaves the past season were nipped by a late spring frost. Evergreen trees turned deciduous! "Never see'd anything like it afore", an old timer told me.

The weather conditions are unquestionably responsible for this widespread damage. From the northern to the southern limits of the Forest along the front range come requests for information and expressions of grave concern regarding this unusually severe winter injury. Roughly, all Douglas fir, Engelmann spruce and Colorado blue spruce above the 7,500 foot contour were so severely injured, either by the severe winter or late spring frost, or both, that little or no new growth was put on lateral and terminal branches. Occasionally a bud escaped injury. Such buds, bursting, made abnormal branches or shoots twice the normal length and size with needles in proportion. Buds on lateral and terminal branches that

were frosted severely make up from 75 per cent to 100 per cent of all the buds on all the trees above the 7,500 foot contour except the pines. Bud clusters have developed during the past season—new buds for the 1931 season two to eight in number. Many forked trunks and branches are certain to result.

Casual weather observations may contribute something in the way of explanation as to just why the winter killing was so noticeably severe.

Water mains four and five feet below the surface froze up in Colorado Springs, Manitou, Castle Rock and other towns adjacent to the front range. In Manitou and Colorado Springs there were many days with low-lying frost clouds during zero and sub-zero periods which completely obscured the sun, while on the summit of Cheyenne Mountain (elevation 9,000 feet), Lake Moraine (elevation 10,000 feet), and the summit of Pikes Peak (elevation 14,000 feet), the sun was shining brightly. Reports from the top of Cheyenne Mountain gave temperatures of from 10 to 40 degrees higher than at Colorado Springs, 4,000 feet lower. Autoists coming down through Ute Pass would report warm and sunny skies at Woodland Park (elevation 8,250 feet). These reports occurred throughout the winter. They indicate great extremes in temperature and probably very sudden changes in the higher regions. Cold, calm air, seemingly, would settle over the plains adjacent to the foothills while the warm prevailing southwest winds blowing above and over this cold air caused the formation of frost clouds. These warm winds were dry, low in humidity, and licked up every bit of moisture from branches and needles except those which, due to shade or shelter, remained continuously frozen throughout the winter and were not influenced by these frequent warm winds. This alternate freezing and thawing with dry winds during the periods of thawing weather were too much for these sturdy old spruce and fir trees, and when spring and summer came, their entire crowns turned brown. A severe June frost nipped the buds that would have put out new needles. So, many of these trees heretofore evergreens are going into the winter as bald and free from leaves as does an elm.

This injury may yet result in death to many trees, but those which survive will record weather—perhaps the most severe winter known in Colorado. Future foresters fifty to one hundred years hence, finding the narrow rings or rings corresponding with about 1930 A. D., will likely say that that was a bad summer drought rather than a severe winter. How many so-called drought periods as told by the trees were in reality injury or late spring frosts?

E. S. Keithley,
Forest Supervisor, Pike National Forest.

An Occupational Study of Graduates in Forestry from the University of Idaho

My interest in the occupational study of graduates in forestry from Cornell University, made by Prof. C. H. Guise, published in the Journal of Forestry in December, 1929; also the report by Prof. Emanuel Fritz on this question, from the University of California, published in the Journal for May, 1929,

has led me to make a similar study of the graduates from the School of Forestry, University of Idaho, the results of which are given in Table 1.

The table shows that of the 103 living graduates in forestry from the University of Idaho, 81 or 79 per cent are still engaged in some phase of forestry work. This percentage coincides with that for the University of California and is rather a high average for any profession.

Of the 74 men receiving only the bachelor degree, 70 per cent are still in forestry work, while of the 29 taking the master's degree either at the University of Idaho or elsewhere, 100 per cent are engaged in work connected with forestry. The larger percentage of master degree men than of those taking only the bachelor degree remaining in forestry is doubtless due to the fact that men are reasonably sure that they want forestry as a permanent objective before they decide to take advanced work in it.

Of the 81 graduates remaining in forestry, it will be noted that 65 per cent are with the federal government. Most of these are in the Forest Service, though the Indian Service and the Biological Survey each claims a few. Twenty per cent are in the employ of private lumber companies, 6 per cent are on faculties of forest schools, 5 per cent are in the service of foreign countries, while 2 per cent are employed as state extension foresters, and 2 per cent are doing postgraduate work.

F. G. Miller,
Dean, School of Forestry,
University of Idaho.

Second Phase of Forest Survey Gets Under Way

The second phase of the nation-wide

Table 1

OCCUPATION OF LIVING GRADUATES IN FORESTRY

UNIVERSITY OF IDAHO

September, 1909, to September, 1930

	All Graduates					
	Master's degrees at U. of I. or elsewhere		Bachelor's degree at U. of I.		Total	
Line of work	Number	Per cent	Number	Per cent	Number	Per cent
Forestry	29	100	52	70	81	79
Other	0	0	22	30	22	21
Total	29	100	74	100	103	100
	Graduates remaining in forestry					
Federal	17	59	35	67	52	65
State	1	4	1	2	2	2
Private	3	10	13	25	16	20
Teaching	3	10	2	4	5	6
Postgraduate	2	7	0	0	2	2
Foreign	3	10	1	2	4	5
Total	29	100	52	100	81	100

forest survey has been inaugurated with the initiation of preliminary work in the hardwood bottomlands of the Mississippi Delta. C. M. Granger, director of the forest survey, and James W. Girard, logging engineer for the forest survey, arrived at the Southern Forest Experiment Station January 10 to assist in the preparation of working plans for carrying on the inventory phase. This work will be under the immediate direction of G. H. Lentz, Silviculturist at the Southern Station.

Lentz was transferred December 1 from his work on soil erosion to take over the hardwood survey. He will be assisted by J. A. Putnam who is an experienced hardwood operator and timber estimator. J. A. Cruikshank, a Junior Forester, will also be on the survey.

There are approximately 25,000,000 acres of land in the alluvial bottomlands of Missouri, Arkansas, Louisiana, and Mississippi to be surveyed under the present set up.

States Receive Share of National Forest Revenues

Twenty-eight states, Alaska and Porto Rico will share to the extent of $1,677,559 in the receipts of the national forests for the fiscal year 1930. This amount represents 25 per cent of the total net receipts, and checks have been mailed from the Treasury Department to the individual states, according to an announcement by the Forest Service.

Net receipts of the national forests last year increased in the aggregate nearly half a million dollars over the preceding fiscal year. The 25 per cent return to the states is allotted in proportion to the receipts realized from national forests within each state. A state's share of national forest receipts represents a federal payment in lieu of taxes. As provided by federal statute, the funds are turned over to the counties containing national forest lands, to be used for schools and roads.

Besides the 25 per cent fund, an additional 10 per cent of forest receipts is set aside each year to be used for forest roads. The 10 per cent fund this year will provide $671,023.72 for building roads and trails within national forest boundaries, supplementing the regular appropriation made by Congress for this purpose.

As the national forests are administered on a permanent yield basis, their revenues are expected to increase in the future as the resources develop says the Forest Service. The states bear no portion of the expense of protecting, administering, and developing the national forests.

Distribution among the states containing national forests of their share of the receipts for 1930 is as follows:

State	25% Fund	10% Fund
Alabama	$ 190.52	$ 76.21
Alaska	27,576.88	11,030.75
Arizona	92,082.37	36,832.95
Arkansas	57,445.87	22,978.35
California	406,877.02	162,750.81
Colorado	141,242.40	56,496.96
Florida	11,481.49	4,592.59
Georgia	4,005.28	1,602.11
Idaho	165,521.20	66,208.48
Maine	1,822.90	729.16
Michigan	1,845.11	738.04
Minnesota	12,340.05	4,936.02
Montana	76,193.88	30,477.55
Nebraska	2,375.04	950.02
Nevada	26,250.48	10,500.19

New Hampshire	25,103.29	10,041.32
New Mexico	35,252.89	14,101.15
North Carolina	10,074.04	4,029.62
Oklahoma	2,110.07	844.03
Oregon	191,772.64	76,709.06
Pennsylvania	3,804.80	1,521.92
Porto Rico	164.77	65.91
South Dakota	44,197.64	17,679.06
South Carolina	1,490.44	596.17
Tennessee	3,467.18	1,386.87
Utah	57,806.17	23,122.47
Virginia	12,308.97	4,923.59
Washington	166,441.10	66,576.44
West Virginia	2,485.53	994.21
Wyoming	93,829.28	37,531.71
Total	$1,677,559.30	$671,023.72

Expansion of Forest Highway Program

Apportionment of $9,500,000 in forest highway funds this fall to 29 states and 2 territories is making possible more rapid road construction on the national forests, according to the U. S. Forest Service.

In most of the regions receiving forest highway funds, the allocated amount will be more than double that of the last fiscal year. For five years the annual federal appropriation for forest highways has been $4,500,000. Under provisions of the Oddie-Colton law, an additional fund of $5,000,000, became available for the first time last July, to be used in the current fiscal year.

Division of these funds for construction of highways within and adjacent to national forests is made on the basis of area and value of the forests. Half the amount is apportioned according to the ratio of the national forest area in a given state to the total area of all the national forests. The other half is divided in proportion to the value of the national forest lands in each state.

This road-building activity, more than doubled this year, is part of a continuing program. An equal amount of federal funds has already been appropriated for the work in the fiscal year 1932.

In addition to the expanded program of forest highway construction, the Forest Service is continuing, with funds from other appropriations, the construction and maintenance work on secondary roads, and on protection roads and trails in the national forests.

The apportionment by states for the current and preceding fiscal years follows:

State	Year Ending June 30, 1931	Year Ending June 30, 1930
Oregon	$1,334,195	$632,638
Washington	669,555	332,614
Idaho	1,036,524	491,648
Montana	837,355	397,999
California	1,428,063	667,175
Alabama	7,558	3,465
Alaska	969,811	460,509
Arizona	599,307	282,288
Arkansas	89,146	41,917
Colorado	692,324	328,044
Florida	28,572	11,436
Georgia	16,570	7,605
Illinois	823	391
Maine	2,880	1,365
Michigan	14,820	3,581
Minnesota	63,078	29,268
Nebraska	9,817	4,659
Nevada	198,858	94,463
New Hampshire	45,171	21,399
New Mexico	425,414	202,401
North Carolina	27,271	12,782
Oklahoma	4,176	1,982
Pennsylvania	16,906	7,403
Porto Rico	1,123	533
South Carolina	3,184	1,474
South Dakota	83,581	39,481
Tennessee	25,175	11,853
Utah	350,105	166,445
Virginia	31,846	14,997
West Virginia	14,809	6,673
Wyoming	441,983	211,512
Totals	$9,500,000	$4,500,000

Game Value Big Factor in Income from Forest

Estimating that the wild life of a single state, South Caroline, is worth approximately $13,000,000 annually, Paul G. Redington, at the South Carolina Commercial Forestry Conference at Columbia, on January 22, emphasized that the wild-life conservationists of the country—professional, organized, and individual—have a direct interest in promoting the forest welfare of State and Nation.

In his dual capacity as chief of the Bureau of Biological Survey, of the United States Department of Agriculture, and president of the Society of American Foresters, Mr. Redington presented important phases of the relation of animals and birds to the forests and the value of forest homes in the perpetuation of useful and interesting species of wild life. He mentioned the early influence of the large and small game of the forests, the fur bearers, and the many species of wild birds in drawing the pioneers out beyond the early frontiers, and discussed the present importance of wild life in increasing land values generally. Forested and uncultivated areas, in particular, produce crops of game and fur annually, he said, while the main forest crop is developing to maturity.

The increasing need for forest-fauna research is being recognized, and the U. S. Biological Survey has been enabled through the McSweeney-McNary Forestry Research Act to assign trained biologists to forest experiment stations to study the interrelations of wild life and forestry, useful as well as injurious. The results of such studies, Mr. Redington said, should be highly beneficial not only economically but esthetically, and should react favorably upon the wild life itself. He announced that he had recently assigned T. D. Burleigh, a forest naturalist of the Biological Survey, to coöperate with the Forest Service at the Appalachian Forest Experiment Station, at Asheville, N. C., his territory to include South Carolina. Commenting on the progress of this work, Mr. Redington said that as both an experienced forester and a careful student of wild life, Mr. Burleigh has already developed significant and valuable information regarding the deer, fur bearers, predators, rodents, and the game birds and other birds of the region. The program of research is designed to develop fundamental facts underlying the relationships of wild life to its environment and to determine the proper relations of wild life and forest production throughout adjacent states.

An estimate of the actual value of the wild life of a state, Mr. Redington said, is arrived at through a consideration of various factors, some definite but others, of which must be approximated. The basic elements, he said, are "the flesh, fur, and feather value; the value of insectivorous habits, as of birds; the recreational value to hunters, tourists, and naturalists; and the commercial value, as it affects expenditures for hunting licenses, clothing and camping equipment, weapons, ammunition, transportation, food and lodging, and a variety of personal services. For example, considering area, topography, and other conditions in South Carolina, the wild life of the state, on its nearly

20,000,000 acres of land and water, is to be estimated as having a direct economic value of more than $8,000,000, and recreational values of probably half as much more.

"Such enormous figures are not mere guesses but are approximated on the average acreage value of wild life. This for the eastern part of the country is arrived at by allowing a meat and fur value of 14 cents an acre, and for South Carolina this would be nearly $2,750,000; the value of birds in destroying insects and other pests (at 26.6 cents an acre), approximately $5,200,000; and the fish production (at 44 cents an acre of water surface), approximately $140,000. To this total of more than $8,000,000 is to be added recreational values arrived at from hunters' license fees (1928-29), $142,026; expenditures of 90,781 hunters (averaging $25 each for equipment, transportation, lodging, and other expenses), about $2,250,000; and the share of the average expenditures that may be attributed to the drawing powers of wild life (at an acreage rate of 13 cents each), more than $2,500,000.

"Thus, with the wild life of South Carolina approximating a value, as nearly as can be worked out, of more than $13,000,000 annually, we have a natural resource of no small magnitude, and one well worth conserving and enlarging. Sane administration of the wild life of forest, field, and stream will develop more fully an appreciation of their great economic value, and this in turn will be reflected in the resulting values of the land and water areas on which the species make their temporary or permanent homes."

In considering the relation of the landowner to the value of the annual crop of wild life, Mr. Redington mentioned the owner's very material interest in determining and employing means for increasing the production of game on his holdings so as to make them attractive to sportsmen able and willing to compensate him for his time and effort through payment for hunting privileges. The landowner, he said, thus becomes directly interested in preventing poaching and forest fires, in repressing other destructive agencies, and in adopting constructive measures for increasing game protection.

Mr. Redington concluded with the prediction that influential organizations, state game wardens and commissioners, and state sportsmen's associations, through a pooling of finances with the agencies of the federal government will make effective the programs of research into problems of wild life and forestry.

417,000 Acres of Forest Land Acquired by United States Last Year

The United States obtained title to 417,064 acres of forest land and the National Forest Reservation Commission approved purchase of 538,048 acres in the fiscal year 1930, according to a report transmitted to Congress by Secretary of War Hurley, chairman of the commission.

Acreage approved for purchase last year exceeded that in any previous year. The area approved, since 1912, amounts to 4,258,564 acres, and purchases completed total 3,413,293 acres.

The commission, in conformity with its general program of national forest purchases, last year approved the establishment of four new purchase units—the Cumberland purchase in Kentucky, the Kiamichi unit in Oklahoma and Arkansas, the Homochito unit in Mississippi, and the Evangeline unit in Louisiana. The total acreage of these newly established units is approximately 1,325,200 acres, and the general program contemplates the eventual acquisition of approximately 1,176,450 acres within these units.

Areas of forest lands approved for purchase by the National Forest Reservation Commission in the fiscal year 1930, and cumulative acreage approved for purchase to June 30, 1930, are as follows:

	Acres approved fiscal year 1930	Total net acres approved to June 30, 1930
Alabama	6,425	109,866
Arkansas	37,118	294,061
Florida	83,796	177,598
Georgia	55,082	319,557
Louisiana	49,860	86,041
Maine	———	33,482
Michigan	50,071	229,946
Minnesota	29,418	106,887
New Hampshire	4,734	487,505
North Carolina	13,398	395,658
Pennsylvania	9,500	354,711
South Carolina	2,762	47,648
Tennessee	8,729	389,907
Virginia	7,450	608,953
West Virginia	17,795	330,380
Wisconsin	161,910	161,283
Total	538,048	4,133,483

Changes in Pennsylvania State Forestry Chiefs

Governor Gifford Pinchot has appointed Lewis E. Staley to succeed Charles E. Dorworth, who was Secretary of Forests and Waters under Governor Fisher's administration. Dr. Joseph S. Illick, State Forester, has also resigned and is succeeded by John W. Keller.

Mr. Dorworth is a publisher of Bellefonte, Pennsylvania. Mr. Staley goes to Pennsylvania from South Carolina where for several years he had been State Forester and organized that state's forestry department. Mr. Staley is not new in Pennsylvania, he is a graduate of Mont Alto Forest Academy (1906) and was in the state's forest employ until 1927. He served in various capacities under Gifford Pinchot when the latter was Commissioner of Forestry, and later during his first term as Governor.

Dr. Illick had been in the employ of Pennsylvania's forestry department since his college days. He is the author of several books and a number of bulletins, and is nationally known for his work and interest in forestry. It is reported that Dr. Illick has accepted a position on the staff of the New York State College of Forestry at Syracuse University.

Mr. Keller, who succeeds Dr. Illick, had been in charge of roadside beautification and protection in the State Highway Department. He was graduated from the Pennsylvania State Forest School in 1910 and has served in the state's forestry department in several capacities. He is to continue his high-

way beautification program as State Forester.

South Carolina Commercial Forestry Conference

The forest interests of South Carolina assembled in a Conference at the Jefferson Hotel, Columbia, S. C., on January 21 and 22, 1931. In a statement on the organization and purpose of the Conference, it was said that the meeting was "called by representatives of commercial, industrial, educational, recreational and civic interests, who have formed a General Committee and arranged a program with the assistance of the Chamber of Commerce of the United States. This Conference is for the development of commercial forestry as a means of perpetuating South Carolina forest resources and is dedicated to the public interests".

More than 120 persons registered at the meeting, which covered a period of two days. Four major phases of the forestry problem in South Carolina were covered by 25 speakers. Under the heading of Forest Wealth, the basic problems as they relate to railroads, farmers, banks, recreationists, county government, the press, women's clubs, public health and power companies, were succinctly discussed by state authorities on those subjects.

The relationship between forest and industry was brought out by such nationally prominent speakers as Mr. Axel Oxholm of the U. S. Department of Commerce, and Dr. Charles Herty, an advisory member of the National Timber Conservation Board.

Private timberland owners discussed the growing and handling of our forests, and the possibilities of increasing forest revenue through proper game management was described by Mr. Paul Redington, Chief of the U. S. Biological Survey.

Forest protection and taxation were covered by presentations by the former State Forester of South Carolina, Mr. L. E. Staley, now Secretary of Forests and Waters of Pennsylvania, and Mr. H. A. Smith, successor to Mr. Staley.

An able presentation on the subject of forest taxation by Mr. R. B. Herbert, an attorney in Columbia, S. C., concluded the Conference.

Exhibits in the meeting hall were both interesting and striking. A display of the forest products manufactured in South Carolina included the two extremes of mankind activities. There was on one end a cradle and at the other end a very well constructed cypress casket. A women's organization presented an exhibit of more than 100 native evergreens to be used for garden and decorative planting.

The complete proceedings of the Conference will be published by Clemson Agricultural College.

Resolutions of the meeting briefly covered the following:

1. A statement of appreciation of the service rendered by the retiring state forester, Mr. L. E. Staley.

2. A request that the state legislature increase the funds available for protection activities.

3. An appreciation of the southern educational project as supported by the American Forestry Association.

4. A request that the U. S. Depart-

ment of Commerce study wood waste in South Carolina.

5. The organization of the South Carolina Forestry Association.

6. A request that the Clemson Agricultural College of Clemson, S. C., institute a course on Game Production.

7. A request that Congress pass a bill providing for erosion study and control in the Appalachian Region.

8. A plea for increased federal support of forest research in the Coastal Plain region.

ALFRED A. DOPPEL,
Chamber of Commerce of the United States.

GRADUATE STUDENT ASSISTANTSHIP AVAILABLE AT FOREST PRODUCTS LABORATORY

The Forest Products Laboratory at Madison, Wisconsin, has an assistantship available for a properly qualified graduate student interested in research in wood technology. The specific research subject pertains to the relationship between wood structure and shrinkage. The research work may be used as a subject for a thesis for a master's or doctor's degree at the University of Wisconsin. The student will be expected to spend about 21 hours a week directly on the research problem. The scholarship carries with it a stipend of $40 a month, and exempts the student from the non-resident fee of $100 per semester.

Further information may be obtained from the Laboratory.

CORNELL RECEIVES GIFTS

Two gifts in support of the work of the Department of Forestry at Cornell University have recently been announced.

Mr. Archer M. Huntington of New York City has biven $5,000 to be used to advance research work on the Arnot Forest, near Ithaca, N. Y. A part of this money is being devoted to investigations of the rate of growth of second-growth hardwoods typical of the region of central southern New York.

In the early autumn of 1930, Mr. Huntington also donated $400 to be given in prizes to the members of the senior class making the best record at the Cornell Forestry Summer Camp.

Shortly before his death Mr. G. Frederick Schwarz of New York gave to Cornell $1,000, to serve as the nucleus of a building fund for a foresters' lodge on the Arnot Forest. It is anticipated that activities on the Forest will be greatly strengthened when a headquarters building, containing living accommodations, an office, and several small laboratories, is available. It is estimated that the simple structure which is needed can be erected for around $5,000.

ERRATUM

In the article "The Effect of Ultra Violet Light in Germination of Seeds and Growths of Seedlings of *Ribes rotundifolium* Michx" in the January, 1931 issue, the following error should be corrected: On page 132, Table 1, last line, *for* Aug. 30, 1929, *read* Aug. 30, 1928.

Three New National Forests Proclaimed

President Hoover recently brought into being three new national forests—the Marquette, the Hiawatha, and the Ottawa—all in Michigan. As a result the United States now has a series of three national forests extending across the Upper Peninsula of Michigan. The Marquette lies near the Straits, the Hiawatha back of Munising, midway of the Peninsula, the Ottawa toward the west end. Within the Marquette, with a gross area of 275,986 acres, the United States owns or is in process of acquiring 109,223 acres. Of the total area of 270,071 acres within the Hiawatha, 95,668 acres is now or soon will be owned by the United States. Less progress has been made in the Ottawa, where out of a gross area of 252,551 acres only 53,379 acres has passed or is in process of passing to the federal government. The program, however, contemplates the eventual acquisition of all the remaining lands chiefly valuable for timber production within the units. This will take place as rapidly as agreements can be reached with the owners and funds are made available by Congress. There are now 152 national forests.

In announcing the creation of the new forests a Forest Service press release reports that: "These lands originally were exploited for their timber. Then followed programs of colonization for agricultural development. It is now evident that the highest use of the lands is for timber production and the government's program is in furtherance of their restoration to that economic purpose. Many of the original residents have moved away, and much of the land is reverting to the state through tax delinquency.

"Several thousand acres of non-producing land within the three new National Forests have already been planted with white and Norway pine and the present program contemplates further planting at an average rate of 2,000 acres per year.

"The Ottawa National Forest was formerly composed largely of privately owned cut-over tracts. In completing this unit the effort is being made to acquire enough mature and second-growth timber of various age classes to make possible an early start on continuous cutting operations. The Forest Service's sustained timber cropping method will aid the maintenance of permanent industries in the region and will bring in a steady revenue, part of which will be turned over to the State for roads and schools.

"In acquiring timberlands and making exchanges, the Forest Service had the hearty coöperation of the Conservation Commission of the State of Michigan, which has also coöperated in perfecting fire prevention arrangements and in moving to bring the contiguous lands back into economic production.

"The three new forests will at present all be under the management of one supervisor, who will have his headquarters at Munising. Ranger stations will be at Munising, Raco, and Kenton".

Connecticut Gives Unemployed Work in State Forests

At the recent annual meeting of the Society of American Foresters, a resolu-

tion was adopted recommending the relief of unemployment by offering work on state forests. Through its State Forester, Austin F. Hawes, Connecticut had already enterd upon such an arrangement and the Governor of the state is recommending an appropriation of $100,000 to continue the project on a larger scale.

An editorial appearing in the January 12, 1921, *Hartford Daily Courant* under the title "The Governor's Forestry Proposal," is worth reprinting. It follows:

"Among the several admirable recommendations made by Governor Cross in his message to the General Assembly is this: That an emergency appropriation be made for thinning the State forests and removing the inflammable debris, thus providing work for the unemployed and rendering the forests less likely to be destroyed by fire. This work would be carried on, of course, under the direction of the State Forester, Mr. Austin F. Hawes.

"Under an appropriation of $7,000 authorized by the Board of Finance and Control, the Forester already has men engaged in clearing the forests of undesirable growths and freeing them of slash. Last week thirty-five unemployed men were hired by the State for this work and twenty others were paid by the city of Waterbury and by private individuals. This week the State expects to put on an additional thirty-five men. The experiment is abundantly justifying itself by the results achieved.

"Care is taken to select heads of families who actually need employment and who have had experience as woodsmen. Among the unemployed there is a surprisingly large number who in their earlier years worked in the woods and have not forgotten how to use an axe effectively. Middletown, Torrington and Willimantic have provided free transportation for these men, and thus the State is under no expense in getting them to and from their work. In addition to those directly paid for their services, the Forester has granted permits to 300 men to cut their own wood in State preserves under the direction of his department.

"All this constitutes a practical method of helping to tide some of the deserving unemployed over this period of distress. It also is a service of estimable value to the State forests. But the $7,000 available to the Forester will be soon exhausted and the work will have to stop unless the Legislature votes the emergency appropriation recommended by the Governor. It is proposed to ask for $100,000, and no similar expenditure could be made by the State to greater advantage. As the Forester says, the 55,000 acres of forest lands owned by the State and variously located are for the most part greatly in need of thinning, and "thousands of cords of wood are going to waste which could be utilized if there were money available for employing choppers and trucks."

"The *Courant* is glad to commend the Governor's suggestion to the favorable consideration of the Legislature. If consideration for the unemployed enters into it, a consideration not to be ignored, there is satisfaction in knowing that the money expended may save the State untold damage from forest fires. The expenditure may be regarded as good insurance if not as an investment. The

people of the State have a commendable pride in their public-owned forests, and anything that tends to preserve them and increase their usefulness is to be encouraged."

How to Judge a House

The National Committee on Wood Utilization has published a very interesting and useful bulletin on judging a house, principally as to the materials and their mode of use and workmanship. The bulletin takes the reader on a tour of inspection from cellar to attic. Such a bulletin has been badly needed. Building standards since the war have been none too high and there seems to be rather general abuse of building materials before and after they are put into a house, by both builder and owner. Many objections to wood and other building materials can be laid at the door of improper use or neglect. For example, every case of decay of wood parts brought to the attention of the editor of the JOURNAL was due primarily to a violation of one or more rules of proper design or construction. The bulletin should be possessed by every owner of a home or other wooden structure, as well as by the prospective builder.

E. F.

Northern Pine Manufacturers' Association Dissolves

At the annual convention of the Northern Pine Manufacturers' Association held in Minneapolis on February 10, the members voted to dissolve the organization.

This marks the end of a pioneer lumber trade association, a pioneer not only as to age but as to setting standards. Many of the problems of later lumber trade associations were worked out by the Northern. The Northern Pine Manufacturers' Association was formed in 1906, a fusion of the Mississippi Valley Lumbermen's Association, formed in 1891, and the Wisconsin Valley Lumbermen's Association. Originally the association had 79 members, and when it voted to disband but five were left; the annual cut, once over two and one-quarter billion feet of lumber, dwindled to a quarter billion feet.

An effort is being made to continue the statistics on northern pine by the National Lumber Manufacturers' Association.

The president of the association at its close was J. A. Mathieu of Rainy Lake, Ontario. W. A. Ellinger has been secretary for a number of years.

E. F.

Forestry Well Represented at Western Scientist Meeting

On December 23, the Pacific Division of the American Association for the Advancement of Science held its annual mid-winter meeting at Stanford University. Forestry occupied a long morning session of the section on Ecology in which it transpired that all of the eight papers were presented by Berkeley men: three from the University of California faculty, four from the California Forest Experiment Station, and one from Aus-

tralia but temporarily established at the Experiment Station.

Dr. W. C. Lowdermilk, of the Experiment Station, discussing the "effectiveness" of rainfall, showed that the total measured catch of rainfull, considered by itself, is not a measure of its effectiveness to vegetation, and is still less an index of the probable yield of water for irrigation and other human uses. Not until the factors which determine the effectiveness of rainfall are isolated and measured can the influence of the surface conditions of watersheds on yield of water be known.

H. L. Sundling, of the Experiment Station, presented the results of tank experiments for measuring erosion from bare soil surfaces as a limiting factor in road gradients. Although *runoff* quantities occurred, roughly, in direct proportion to degree of slope, *erosion* quantities appeared to correspond to intensity of rainfall irrespective of degree of slope.

Emanuel Fritz, of the University of California, told of finding the fruiting bodies, hitherto undiscovered, of the common brown heart-rot fungus of California redwood, and discussed the exacting conditions under which they develop.

Prof. Lee Bonar followed with a paper on the same fungus, describing the sporophores themselves and giving his basis for classifying it as a new species of Poria, for which he proposes the name *Poria sequoiae* sp. nov.

Dr. A. W. Sampson, of the University of California, gave the gist of his report, now in process of publication, on eradication of the Klamath weed, *Hypericum perforatum*, which is vigorously invading grasslands of northern California. Methods of control on small areas have been developed and give promise of checking the plant's spread, if rigorously applied.

A. D. Lindsay, of the Australian Commonwealth Forest Service, at present engaged in studying certain North American conifers in their native habitats, presented an interesting paper on the acclimatization of exotic conifers in Australasia, describing particularly the conditions of favorable rainfall and temperature which account for the rapid growth rates of planted Monterey pine. What is not generally known to American foresters is that a large number of exotic conifers, in addition to Monterey pine, have also been tried in New Zealand and Australia.

C. J. Kraebel, of the Experiment Station, discussed plant succession following fire in the chaparral of southern California. A quick abundant growth of ephemeral herbaceous plants, which are individually weak and insignificant, usually follows chaparral fires and exerts in the aggregate a considerable control upon runoff and erosion. Gradual deterioration of chaparral types results from soil impoverishment caused by erosion following frequent fires.

H. L. Person, of the Experiment Station, in a paper on tree selection by the western pine beetle, summarized the results of investigations into the external characteristics of attractive trees, and gave a theory for their selection on the basis of recent chemical-physiological studies.

C. J. Kraebel,
California Forest Experiment Station.

CORRESPONDENCE

Governor Pinchot Felicitates Annual Meeting

Harrisburg, Pa.
December 27, 1930.

Mr. Paul G. Redington,
Society of American Foresters,
Washington, D. C.

Dear Redington:

I am more sorry than I can say that the immense pressure of work here makes it altogether impossible for me to attend the Annual Meeting of the Society of American Foresters. The honor and pleasure of presiding at the Thirtieth Birthday Banquet, as you so kindly invited me to do, looked mighty good to me, and I honed to come.

But without avail, for if I am to make good as a forester-governor, and therefore in some sense a representative of the Society, this is just the time when I must attend to my knitting. Not even the pleasure of greeting old friends and co-workers can be allowed to take me off the job. I am sure you and they will fully understand and sympathize with my situation.

In the light of the present size, importance, and influence of the Society, I look back with genuine satisfaction to the meeting of a handful of foresters at my office on November 30, 1900, when the Society of American Foresters came into being. Of that little group all but Overton Price, the best of us all, are still living. I think that Graves, Sherrard, Hosmer, Hall, Allen, and I can without presumption, and even without danger of figuring as has-beens, go so far as to claim the distinction of founders. We may claim too that we did a good job and that we have a special right to be proud of the growth, achievements, principles, and purposes of the Society.

My mind runs back to the early meetings at 1705 Rhode Island Avenue, and the later meetings at 1615 in the same street; to the baked apples and gingerbread; to the momentous evening when President Roosevelt addressed us; and to many another event worth recalling. But since I cannot be with you to speak of the past perhaps I may say a word or two about the future.

One thing that is emerging more and more clearly, as a stable principle in this time of swift change, is the planned and orderly use of natural resources. Of these wood is one of the chief. No amount of juggling with words and statistics can reduce the permanent importance of forests to mankind.

American foresters have always recognized this fundamental fact, and have had more to do with securing its wide acceptance than any other body of men. My point now is that the need for conservation, and for forest conservation in particular, is greater than ever be-

fore, and the argument for its practice clearer and stronger.

The time is ripe for a great advance in forestry for America. The Society of American Foresters has only to choose in order to assume the leadership of that advance. The internal affairs of the Society are in better condition than ever before, so that it has more free energy to devote to its larger responsibilities. And I think we are unanimous in recognizing that the Society has a great and wide public responsibility to stand up for and to protect the public interest in the forest.

The breakdown of "voluntary cooperation" as the solution of the problem of forestry destruction must be evident to every competent observer. We cannot solve our problem except through other methods of attack. I feel sure that the sound common sense of the Society will reject the counsels of overcaution, inaction, and delay, and turn to the aggressive pursuit of clear cut objectives along clear cut lines.

The Society might well give its best efforts to putting an end to forest devastation. That is our central problem. A remedy must be found, a remedy can be found, and the foresters are the men to take the lead in finding it.

There is only one answer to the problem of forest devastation and that is public control of the axe that causes forest devastation. There will naturally be much resistance, interested and otherwise, to such control, and many differences of opinion as to how to achieve it. But in my judgment the greatest responsibility and the greatest opportunity of the Society lie in constructive dealing with this fundamental problem. Unless we solve it forestry as a profession and the Society as its mouthpiece must necessarily fail.

I am most anxious to have my fellow members of the Society understand how deeply sorry I am not to be with them at this memorable celebration. My warmest greetings and good wishes go to you, to them, and to the Society itself.

Faithfully yours,
(Signed) GIFFORD PINCHOT.

WILL THE WILDE AND SCHOLZ METHOD OF SUBDIVIDING FORESTS WORK?

The Editor
Journal of Forestry.

In the December 1930 issue of the JOURNAL, page 1104, is an article entitled *"The Basis for Subdividing Mountainous Forests for the Purpose of Management"*. A careful study of the proposed scheme of subdivision reveals a few features wherein its value for practical application, in many cases, under present-day conditions appears to be questionable.

Before calling attention to these specific features the writer wishes to make clear that theoretically the proposed plan seems to be an admirable one and that he is entirely in agreement with such a method, provided it can be applied practically and economically. Realizing that any considerable advance in forestry practice in this country will come through sound scientific investigations backed up by successful practical applications, the writer congratulates

the authors for contributing this new viewpoint on the subject of forest subdivision in mountainous regions. However, unless such theories can be reasonably applied in the field they are bound to remain just theories.

The chief objections to the authors' scheme can be summarized under three headings, to-wit:

1. The establishment and maintenance cost would be too high to be practical.

2. The subdivision, as embodied in the authors' example, does not completely carry out their theoretical scheme and hence it falls down through lack of universal application.

3. The scheme does not seem practical from the standpoint of present-day utilization practice.

In defense of these assertions it can be said:

1. It does not seem reasonable that under present-day practice the expense of establishment and maintenance of such a subdivision is justified. The authors admit, or imply, that, once established, a compartment subdivision should be considered as a permanent feature. Permanence calls for the continual maintenance of the compartment boundary lines. To fulfill this requisite, compartment lines must either lay along some permanent natural or cultural feature, as streams, ridge-tops, roads, stone-walls, etc., or must be artificially established through the woods by such means as clearings or blazed or painted lines. A study of the authors' subdivision shows that (assuming the area to be covered with some kind of tree growth) most of the compartment lines would have to be artificially established through the woods.

Provided distinctive variations in cover-types were present it could be argued that the type boundaries might serve as compartment lines. In this connection, even lines of division between widely-separated age-classes might be held forth; both features being offered as possible means of eliminating the necessity of establishing so much artificial compartment boundary line. The chief objection to this type of compartment boundary is that it lacks the degree of permanence necessary. It is well recognized that such boundaries, due to growth, infiltration of adjoining types, and gradual or even complete changes in composition, are but temporary things at best. These gradual changes in the forest would tend to vary the areas within compartments so marked out, with eventual fatal results to any precise plan of regulation based wholly, or in part, upon areas.

Compartment subdivision must rest upon some well-defined, permanent or non-changing skeleton. To achieve this, the authors' suggested subdivision would call for the expenditure of considerable sums, both for establishment and for maintenance of the compartment lines. Maintenance would be no small item, especially if any system of cleared lines were used. Even with painted lines, the item of labor alone makes maintenance quite expensive.

Contrast this scheme with Roth's subdivision where, to a large extent, streams and prominent ridge-tops (permanent natural-features) have been used; and the excessive cost of establish-

ing and maintaining the authors' subdivision will be readily recognized.

2. A detailed comparative study of the two schemes of subdivision does not show that much has been achieved by the authors' plan toward furthering the attainment of their theoretical ideal:—"a segregation of ecological or physical site factors" on the basis of topography.

For example, the area included in compartments 27, 28, 44 and 45 under Roth's plan has been divided to fall within compartments 29, 32, 33, 34 and parts of 35, 22, 23, 28, and 31 under the authors' scheme. Compare Roth's compartment 27 with the authors' compartment 29 and Roth's compartment 45 with the authors' compartment 32. In the first case, Roth includes a variation in elevation of approximately 750 feet. The authors in compartment 29 have included about a 700-foot variation. In the second case, Roth shows a change of about 750 feet while the authors' change in elevation within compartment 32 amounts to over 600 feet. To the east of the stream practically the same comparative conditions exist. The ideal system set up by the authors is evidently to include within any one compartment only one species or type, one age-class and but one class of soil, "homogeneous in its physical and chemical composition, depth and water-absorbing qualities", as outlined in the Russian official instructions of 1900. It does not seem logical that lowering the compartment lines some 50 to 100 feet in elevation from the ridge-tops will eliminate all variations in soil-qualities, site-factors or cover-types on the remaining area down to the streams.

The Southern Appalachian region is used as an example of a place where types may be found varying with the topography. Here four distinct types, cove, lower-slope, moist protected upper-slopes and exposed dry upper-slopes are recognized as occurring between the streams and the ridge-tops. Certainly the system of subdivision, as laid out on the authors' map, would not apply in many localities in the Southern Appalachians. To keep entirely within the theory outlined there would have to be at least three compartments established between the streams and the ridge-tops. In many cases all four types might be found within an area that could readily, under Roth's system, fall into one compartment. This would call for four compartments under the authors' scheme. It is interesting to note, in this connection, that after a thorough study of the application and practical value of different methods of subdivision, the staff of the Southern Appalachian Forest Experiment Station recently adopted a system very comparable to that of Roth's, in establishing a permanent compartment subdivision on the new Bent Creek Experimental Forest.

Perhaps in the Sierras (location of Roth's example) only two variations in the desirable components for one compartment exists between the streams and the ridge-tops. This is not believed to be the case, however. At any rate it is not reasonable that from the stream upward approximately six-sevenths of the area would contain but one species or type, age, and, most important, one class of soil and site-factors, while the remaining one-seventh (assumably the dry upper-slopes) constituted the only

distinct variation in these factors. It is much more likely that two or more changes would be present below the authors' hypothetical line. Any variation at all would preclude the achievement of the authors' ideal and present but a contracted application of Roth's scheme.

3. The scheme is not believed to be practical from the standpoint of present-day logging practice. If the authors have in mind the operation of single compartments as units, the plan proposed is not sound.

Assuming that for silvicultural and administrative purposes an entire compartment which straddles a ridge-top were to be logged over in one and the same operation; the output from such a compartment would necessarily have to be diverted to from two to four different outlets. On the basis that river-driving was the practical means for transportation of the product, the harvest could later be concentrated only at some point far down on the main drainage. Such a diversion of output and resultant duplication of much effort costs money. The operator must spread out over much more territory with a consequent reduction in the margin left for stumpage.

Were it necessary to construct roads or railroads to get the product out, the excessive cost of such a diversion is all the more pronounced. In order to harvest the product of one of these ridge-top compartments, it would be necessary to build and maintain, or to repair at the time of the next cut, the means of outlet. Such outlets would have to pass through one or more of the lower compartments. Whatever form the means of outlet take—roads, skidways, slides or chutes, they would have to be definite arteries. More or less indiscriminate hauling, skidding or sliding down through a stand which was not being operated could not be tolerated. On the other hand, such activities are, in a broad sense, part of an operation which extends over the entire area, or from ridge-top to stream. Thus the cost of original establishment and the cost of maintaining or repairing outlets for these more or less isolated ridge-top compartments, would be too excessive to be practical, or, in many cases, to leave any margin for stumpage.

Practically the same factors, with the exception of the item of diversion, would operate to make the logging of any single compartment on the slopes an impractical idea. It must be admitted that in the coves and along the streams such a logging practice would work exceptionally well. If such a practice were followed, however, it would tend to materially reduce the value of stumpage left in the upper compartments.

From the practical viewpoint, it is not believed that entire ridge-top compartments would be logged singly. This certainly could not be done at a profit under present-day conditions. Few operators would be interested in such a proposal, though many could be found who would be willing to log only the lower compartments. In order to get any cutting done, in other words—to apply any silviculture, in the upper compartments, the forest manager must insist that the "skimmed milk" from the upper compartments be taken along with the "cream" from the lower compartments. Ordinary common sense in

woods operation under present-day utilization practices and economic conditions, indicates that a system of logging by watersheds is by far the most feasible one.

If the authors have in mind adhering to the present-day practice of logging, no particular advancement is made through their scheme. Several compartments, containing several types and perhaps producing several different products, would be cut-over at the same time. Any changes in the type of silviculture practiced would come at about the same place as they would under Roth's scheme of subdivision. Fully as much detailed supervision would be necessary to insure application of the correct practice. In fact no advance has been made in most of the items on which the authors object to a subdivision which groups together different forest types. "Needless complication of silviculture" has not been simplified. The "oftentimes reduced increment" has not been supplemented nor has the "prevention of securing uniformly good natural reproduction" been enhanced. It must be admitted that complications of management have, to some extent, been simplified, since for purposes of office computations and regulation, a theoretically ideal paper-system has been set up. It should be emphasized that if such an ideal system could be practically correlated with operations on the ground there would be no point to this comment. Forest subdivision in mountainous regions, somewhat along the lines suggested by the authors, would be accepted and adopted as a matter of course. The advisability of adopting such a method at present, however, seems to boil down to two definite questions:

1. Can the few advantages to be gained under the proposed scheme justify their apparent high cost in face of the fact that the plan as a whole does not appear economically appliable? The answer to this question is believed to be—no.

2. Are we justified in present practice in our mountainous regions to looking forward to the time when silvicultural practice will be on such an intensive scale and economic conditions will be such, that separate compartments can be profitably operated *regardless* of their location? If the answer to this question be yes, then the authors' scheme has much of merit and should be given thorough consideration. While the writer hopes that the time is "just around the corner" when such conditions will exist, he cannot help but believe that it is a long, long way off. In the meantime, much real progress can be made in forest management by tempering our "present-day scientific" theories to meet practical possibilities.

WILLIAM MAUGHAN,
Duke Forest,
Durham, N. C.

SOCIETY AFFAIRS

Suggestions to Prospective Authors

A single issue of the Journal requires about 100 hours on the part of the editor. Prospective authors by observing certain simple rules of writing, can greatly lighten this load. Some articles require many hours to put into proper form for the printer. The supply of material is not so plentiful that such articles can always be returned to the author for rewriting.

To date the standard adopted for the Journal has not been adhered to strictly when articles were differently prepared, and when changing them required more time than was available. Coöperation of authors to improve this situation is requested. Section secretaries, heads of offices, and others submitting articles on behalf of members or subordinates will confer a favor if they will examine them for style, the completeness of references, tables, etc.

Below are a few suggestions which if observed will produce articles that require a minimum of editing, and will assure early publication.

1. The subject must be original, of more than local interest, and timely.

2. The paper should be typewritten on one side of the sheet, double-spaced, on white or yellow paper. Avoid onion skin papers.

3. Leave wide margins, 1 to 1.5 inches, on each side of the sheet. Leave triple space or more between title and body of text.

4. Submit the original copy, not weak carbons.

5. Type in the name of the author as it is desired it should appear, *plus* his title and organization. Follow form used in the Journal.

6. Do not underscore anything, titles and otherwise, except scientific names, or phrases to be set in italics for emphasis.

7. Give the reader a chance to view the problem to be discussed by means of a brief and pertinent introductory paragraph.

8. Close the article with a brief statement of conclusions or summary if possible.

9. Use none but legitimate abbreviations in the body. Do not use per cent signs or fractions but write them out. The abbreviation "d. b. h." is considered legitimate, but should be typed in lower case letters.

10. The first time a botanical species is mentioned give its botanical name in parenthesis right after the common name. Thereafter the scientific name need not be repeated. Check the spelling of such names. The name of the botanist originating the name should be included. Thus, "white pine (*Pinus strobus* L.)" or "red oak (*Quercus borealis* Michx.)"

11. Avoid footnote references to lit-

erature cited. Refer to them by number, thus, "Hooker (4) found that by, etc." Arrange all citations *alphabetically* by *authors*, and *numbered serially* in a final note entitled "References". Reference No. 1 is thus not necessarily the first one mentioned in the text. See that reference numbers used in the text correspond with those used in the list. Arrange the titles of the literature cited in a standard order, thus

8. Meinecke, E. P. 1917. Basic problems in forest pathology. Jour. For., Vol. 15, pp. 215-224.

Include all necessary data, don't leave dates, initials, etc., for the editor to look up.

12. Resort to centered subheads in lengthy articles if the subject permits.

13. Number all tables and figures (even if there is but a single one of either) and refer to them by such number. Do not write "In the following table is shown", but "Table 1 shows". It may not be possible to set the table in the regular sequence.

14. Type all tables according to the style used in the JOURNAL.

15. Check tabular material against the original carefully. Errors in transcription, addition, referencing and the like are very common and are easily missed by the editor.

16. Prepare titles for all figures. Keep in mind always how the figure will look when reduced. Titles need not be incorporated in the figure, they can be set in type after the cut is made.

17. In the case of reviews, prepare a title according to the form and style used in the JOURNAL. Do not type titles in capital letters. Be sure to include all pertinent reference data—date and place of publication, cost if known, volume, number, pages, etc.

EMANUEL FRITZ,
Editor-in-Chief.

C. R. ANDERSON 1885-1931

On January 30, 1931, Clarence R. Anderson, senior member of the Society of American Foresters, died at the hospital, Huntingdon, Pennsylvania, after a month's illness. He was buried at State College, Pennsylvania.

Readers of the JOURNAL will recall the able article from his pen which appeared in the January number, *A Decade of Forestry Extension Work in Pennsylvania.* One pauses a bit to wonder whether some premonition prompted him to set down just when he did this clear-cut statement of his accomplishments as Extension Forester. At any event the record was worth the writing since it records ten years of pioneer work.

Extension is the newest comer to the increasingly diversifying field of professional forestry. The Clarke-McNary Act which gave it national impetus is but seven years old, and only two other states besides Pennsylvania were using state funds to support forestry extension work prior to 1920.

Just as the names of Gaskill, Besley and Holmes are inseparably connected with the development of state forestry, so "Andy's" name will always be associated with the real beginnings of extension forestry. To an unusual degree he had those qualities of contagious enthusiasm, zeal and good fellowship, which inspire confidence in those with

C. R. Anderson
1885-1931

whom contact is made. It was these qualities of leadership coupled with a vision of the sound practical application of forestry principles to the farm woodlands, that enabled him to make, as his article records, such a far reaching impression on the farmers of Pennsylvania.

It is given to other foresters to leave behind them living monuments in forests they have planned and planted, or other forests they have protected and cared for and improved. The extension forester's monument is in the hearts of his fellow men,—hundreds, yes, thousands of land owners who have caught from him the vision of the practical application of forestry to their own lands, and have become "woods-minded". Such a monument Anderson has left behind him in Pennsylvania. Nor was the value of his leadership confined within the borders of the State. We others in the extension field have received inspiration and encouragement to follow the trail which he has blazed.

Anderson was born in Cecil County, Maryland, on July 23, 1885. He attended Dickinson College, obtaining the B. S. degree in 1908, and Yale Forest School, from which he obtained the M. F. degree in 1913. From 1908 until 1911 he was instructor in the high school at Savannah, Illinois. For a year following his graduation from Yale he served as Forest Assistant in Montana and Idaho, leaving this work to become instructor in forestry at Pennsylvania State College. In 1921 after having reached the grade of Associate Professor in Forestry he changed from teaching to extension work with the same grade, becoming Professor of Forest Extension in 1927. He is survived by his wife, Dollie J. Anderson, and two sons, Clarence and Russell, aged 14 and 7 years respectively.

Joshua A. Cope,
Cornell University.

Forest Ranger Pulaski Dies

Edward C. Pulaski, for many years forest ranger on the Coeur d'Alene National Forest, died on February 16, 1931, at his home in Coeur d'Alene, Idaho. He had been retired from active service only a few months before his death. He was a junior member of the Society.

"Ed" Pulaski won national fame in 1910 when he saved the lives of several

scores of fire-fighters during the great forest fires of that year when his crew became surrounded. He was a direct descendant of General Pulaski of Revolutionary War fame.

Ranger Pulaski carried his honors with great modesty. Every young forester who came in contact with him loved him for his sympathetic helpfulness and all respected his experience and ability.

Further details are expected for a more extended account of his life and death.

E. F.

Secretary Hyde Acknowledges Resolutions

Jan. 28, 1931.

Mr. Paul G. Redington,
President, Society of American Foresters, Washington, D. C.

Dear Mr. Redington:

Your letter of January 8, enclosing resolutions approved by the Society of American Foresters at its annual meeting December last, is received.

The Department greatly appreciates the interest of the Society in the provision for a forester in the Foreign Agricultural Service. Unless you have been informed already, you will be interested to know that the item for this purpose which was eliminated in the House has been restored to the appropriation bill for 1932 by the Senate Appropriations Committee.

I understand that ways and means for a more satisfactory handling of progress reports has been under consideration from time to time between the Office of Information and the Forest Service. I am requesting that the matter be taken up again, because I believe with the Society that it would be exceedingly desirable from the standpoint of the development of forestry in the United States if some satisfactory arrangement could be devised for making reports on the results of research, and particularly progress reports, available promptly.

Very sincerely yours,
(Signed) Arthur M. Hyde,
Secretary.

Report of the Committee on International Relations

The purpose of the standing Committee on International Relations is to establish and maintain friendly contacts with the forestry organizations and with individual foresters in other countries, and to foster the interchange of material of mutual interest and benefit. This it does in three ways—by facilitating personal contacts; by helping to arrange the exchange of publications; and by the advancement of matters and projects that are of common interest.

Lack of funds necessarily precludes numerous activities that might properly lie within the functions of the Committee had its members the time to give to

them. But as opportunity offers, from time to time, the Committee is prepared to be of service.

In a letter sent in the autumn of 1930 to the officers of the societies of professional foresters in European countries, the offer was made to aid foresters visiting the United States by arranging their itineraries, by helping them to meet the specialists and others whom they most desired to see, and in other ways by assisting them to accomplish most fully the purposes of their respective visits.

This offer was combined with an invitation that delegates be sent to the Thirtieth Annual Meeting of the Society in Washington in December, 1930. As a result three European countries, France, Great Britain and Switzerland, and also the Dominion of Canada and Mexico, were represented at the "Birthday Banquet" on December 29. Cordial responses to this letter were received from all the countries, and in a number of cases the letter itself was printed in the journal of the national forestry organization.

In several instances during the year some help at least has been given visiting foresters. On the other hand word comes to the Committee of many courtesies that have been extended to American foresters visiting other lands.

In this connection note may be made of a series of lectures given at various forest schools in the east during the autumn of 1930, by Mr. Wilfrid E. Hiley, Lecturer at the Imperial Forestry Institute at the University of Oxford, England, and Editor of the *Quarterly Journal of Forestry* of the Royal English Arboricultural Society.

Among the things that have been suggested as appropriate activities for this Committee are the preparation of lists of men and of places likely to be of most interest to foresters from abroad; steps to better the opportunities of American foresters who go overseas by arrangements made in advance with the forest officials of other countries; aid in improving and simplifying the mechanical routine that attends the exchange of publications so that more may be both sent and received; and the strengthening of the relations between this Society and such organizations for example as the International Union of Forest Research Organizations.

It has been further suggested that in time the Socety of American Foresters might enter into some form of coöperative arrangement looking to facilitating the preparation of international dictionaries of forest terms and other publications of such character as are of mutual help to the foresters of several countries. Such work might even extend to coöperative effort concerning forest bibliographies, a subject that in past years has had the attention of a special committee of this Society.

The Committee has learned recently of a proposal in which it is greatly interested, namely that Congress authorize the sending of an American forester to Europe, with semi-diplomatic status, as a special agent of the U. S. Department of Agriculture, to obtain at first hand information of various sorts about forestry that can be secured only through personal contacts. Such a person, as a member of this Committee, could in addition to his regular duties, accomplish promptly and efficiently some of the things that can now only be

brought about after long drawn out correspondence. It is greatly to be hoped that Congress will make the necessary authorization for this work in Europe.

For the Committee,
RALPH S. HOSMER,
Chairman.

NEXT ANNUAL MEETING TO BE IN NEW ORLEANS

The thirty-first annual meeting of the Society has been tentatively set for December 29-31, and the meeting place is to be New Orleans. This is considered a timely move because much is going on in the South that is of interest to foresters. The third day of the session will likely be a field trip to a forestry operation in the southern pine region. The meeting of the American Association for the Advancement of Science, to be held at New Orleans at the same time, will draw a sufficiently large number of visitors to assure reduced railroad rates to all.

President Redington has appointed a Committee on Meetings with G. H. Lentz of the Southern Forest Experiment Station as chairman. The other members are to be Robert Moore of Louisiana State University; E. L. Demmon, Director, Southern Forest Experiment Station; G. R. Phillips, State Forester of Oklahoma; and I. F. Eldredge, Superior Pine Products Company, Fargo, Georgia. This is probably the first time the Society's annual meeting place and meeting's committee have been determined upon so early in the year, thus assuring the Committee plenty of time to prepare for a well-organized gathering.

ROCKY MOUNTAIN SECTION AFFILIATED WITH COLORADO ENGINEERS

The Rocky Mountain Section of the Society is closely affiliated with the Colorado Engineering Council. In the *Engineers Bulletin* for January, 1931, the official organ of the Colorado Society of Engineers, the section has equal prominence with the local sections of the A.S.C.E., A.S.M.E., A.C.S. and others in the department on local notes, and a cut of the Society pin is used as an illustration. Fred R. Johnson, a senior member of the section, is this year's secretary of the Colorado Engineering Council.

CANADIAN FORESTERS SEND THANKS

The secretary's office is in receipt of the following resolution passed by the Canadian Society of Forest Engineers at its recent annual meeting:

"That the Society desires to record its appreciation of the presence of its distinguished visitors from the United States, and thanks them most heartily for their contribution to the programme".

A. H. RICHARDSON,
Secretary,
Canadian Society of Forest Engineers.

Committee of Nominations

The membership of the Committee on Nominations, as suggested by President Redington, was approved by letter ballot of the Council. The membership is as follows:

W. L. Hall, Chairman,
Hot Springs, Ark.
R. C. Bryant,
New Haven, Conn.
Allen Peck,
Denver, Colo.

Suggestions for nominations and petitions should be sent to the Chairman for consideration.

Binders for the Journal

It has been suggested that binders for the Journal of Forestry be made available to members and subscribers. The Society is considering a loose leaf binder of heavy-weight Fabrikoid over-stiff board which will sell for $1.75. This binder will hold eight issues of the Journal (a year's supply) and the backbone will be stamped in imitation gold "Journal of Forestry". The binder is durable and will last over a period of years.

The binder should prove of particular interest to those members who wish to preserve their Journals and to such subscribers as libraries, universities, and lumber companies which make ready use of the Journal for reference. To get a low price the Society should purchase at least one hundred binders. Before proceeding with this purchase we would like reservations made to the extent of 100. If you are interested in such a binder for $1.75 each, will you send your reservation without delay to the Society's business office, 810 Hill Bldg., Washington, D. C.

L. A. Warren,
Business Manager.

FORTHCOMING EVENTS

31st Annual Meeting
Society of American Foresters
December 29-31, 1931
New Orleans, La.

Annual Meeting
Georgia Forestry Association
May 20-21, 1931
Albany, Ga.

Annual Meeting
Nat'l Lumber Mftrs. Assoc.,
April 22-24, 1931
Congress Hotel, Chicago, Ill.

Third Soil and Water Conservation Conference, June, 1931
Fayetteville, Ark.

Joint Meeting
American Forestry Association
and
North Carolina Forestry Association
June 2-4
Grove Park Inn, Asheville, N. C.

Section secretaries are welcome to use this box for announcing their meetings. Copy should be in the hands of the Editor or Executive Secretary one month before date of publication.

Elections to Membership

The following men have been elected to the grade of membership indicated.

ALLEGHENY SECTION

Junior Membership

Cranmer, Carl B.
Hoffman, Jacob M.
Mausteller, John E.
Pfeiffer, William H.
Trunser, Joseph J.
Williams, Thomas C.

APPALACHIAN SECTION

Senior Membership

Flory, Charles Henry

GULF STATES SECTION

Junior Membership

Eberly, H. J.
Heyward, Frank, Jr.
Holmes, Kenneth Hugh
Reynolds, Russell R.
Siggers, Paul V.
Scheffer, Theodore C.

NEW ENGLAND SECTION

Junior Membership

Diller, Jesse D.
Garstka, Walter Urban
Genth, Gustav W.
Lambert, John H., Jr.
Lathrop, Clayton Huntington
Miller, William Dukstra
Rawson, Lovell Cook
Richardson, Leroy Mowry
Ricker, Milton Burnham
Wilford, Bill H.
Winch, Eugene C.

Senior Membership

Averill, Robert W.
Averill, Walter B.

NEW YORK SECTION

Junior Membership

Cruikshank, James W.
Dorr, Henry, Jr.
Unger, Ralph G.

Senior Membership

Winslow, Paul T.

OHIO VALLEY

Junior Membership

Bower, Ray F.
McKennan, R. B.

SOUTHEASTERN SECTION

Junior Membership

Bennett, John H.
Coulter, Clinton Huxley
Young, G. A.

WISCONSIN SECTION

Junior Membership

Chapman, A. Dale

MEMBERSHIP OF THE SOCIETY OF AMERICAN FORESTERS
BY SECTIONS

January 20, 1931

Section	Fellow	Honorary	Corresponding	Senior	Junior	Associate	Total
Allegheny				75	94		169
Appalachian				23	38	1	62
California				59	91	10	160
Central Rocky Mtn.				31	65	1	97
Gulf States				15	27	2	44
Intermountain				14	42		56
Minnesota	1	1		25	33	1	60
New England	4			83	100	7	196
New York		1		43	84	6	134
Northern Rocky Mtn.				50	67	1	118
North Pacific	1			70	107	2	180
Ohio Valley				35	41	2	78
Ozark		1		6	18		25
Southeastern				14	31	2	47
Southwestern				16	19	1	36
Washington	5	2		70	24	10	111
Wisconsin				32	19	2	53
TOTAL (organized)	11	5		661	900	48	1,626
Foreign (unorganized)		9	6	26	33	1	75
GRAND TOTAL	11	14	6	687	933	49	1,701

ANNOUNCEMENT OF CANDIDATES FOR MEMBERSHIP

The following names of candidates for membership are referred to Junior Members, Senior Members, and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the March JOURNAL, without question as to eligibility; the names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before May 15, 1931. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Name and Education	*Title and Address*	*Proposed by*
Anderson, A. H. Penn. State, B. S. F., 1928.	District Ranger, Ouachita N. F., Waldron, Ark.	Ozark Sec.
Austin, Albert C. No technical training.	Forest Ranger, Missoula N. F., Missoula, Mont.	Northern Rocky Mt. Sec.
Averill, Clarence C. Univ. of Mont., B. S. F., 1929. 1 yr. Harvard Forest.	Working on Masters Degree at Harvard Forest, Petersham, Mass.	New England Sec.
Baird, J. S. No technical training.	Senior Forest Ranger, Kootenai, N. F., Troy, Mont.	Northern Rocky Mt. Sec.
Barron, J. S. Univ. of Maine, B. S. F., 1921.	Forester, Diamond Match Co., Spokane, Wash.	Northern Rocky Mt. Sec.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Beard, Le Baron N. Univ. of Mont. 2 yrs.	Principal Forest Ranger, Pend, Oreille N. F., Sandpoint, Idaho.	Northern Rocky Mt. Sec.
Beck, Don W. Penn State, B. S. F., 1926.	Principal Forest Ranger, Ouachita N. F., Ark.	Ozark Sec.
Byers, C. R. No technical training.	Principal Forest Ranger, Kootenai N. F., Libby, Mont.	Northern Rocky Mt. Sec.
Carlson, Floyd E. Univ. of Wash, B. S. F., 1928, M. F., 1930.	Instructor, Forest Extension, N. Y. State, Syracuse, N. Y.	New York Sec.
Clover, O. V. No technical training.	District Ranger, Nezperce Forest, Whitebird, Idaho.	Northern Rocky Mt. Sec.
Collins, V. L. No technical training.	District Ranger, Nezperce Forest, Grangeville, Idaho.	Northern Rocky Mt. Sec.
Coster, R. A. No technical training.	District Ranger, Beartooth N. F., Bowler, Mont.	Northern Rocky Mt. Sec.
Crocker, Clayton S. High School. 2 short courses in forestry.	Senior Forest Ranger, Selway Forest, Lowell, Idaho.	Northern Rocky Mt. Sec.
Davis, Kenneth P. Univ. of Mont., B. S. F., 1928.	District Ranger, Absaroka N. F., Gardiner, Mont.	Northern Rocky Mt. Sec.
Dence, Welford A. N. Y. State, B. S. F., 1920.	Assist. Director, Roosevelt Wild Life Forest Exp. Sta., Syracuse, N. Y. Continuing study of Ichthyologist, N. Y. State.	New York Sec.
DeLeon, Donald N. Y. State, B. S. F. and M. S.	Assist. Entomologist, Field Sta., Coeur d'Alene, Idaho.	Northern Rocky Mt. Sec.
Eddy, Leslie E. 3½ years Univ. of Idaho.	District Ranger, Coolin, Idaho.	Northern Rocky Mt. Sec.
Ellis, Wilfred E. N. Y. Ranger Sch.	Forester, Tensas Delta Land Co., 1012 St. John St., Monroe, La.	Gulf States Sec.
Eliason, Everett J. Purdue, B. S. F., 1923; N. Y. State, M. S., '25. 3 more yrs. graduate work.	Assist. Forest Pathologist, N. Y. Conservation Dept., Albany, N. Y.	New York Sec.
Ewan, L. E., Jr. No technical training.	Senior Ranger, Gallatin Forest, R. F. D. No. 4, Bozeman, Mont.	Northern Rocky Mt. Sec.
Ferguson, R. S. Two yrs. study of forestry.	Senior Forest Ranger, Selway N. F., Kooskia, Idaho.	Northern Rocky Mt. Sec.
FitzGerald, R. C. No technical training.	Principal Forest Ranger, Bitterroot Forest, Hamilton, Mont.	Northern Rocky Mt. Sec.
Frost, Levi M. Univ. of Mont., B. S. F., 1929.	Junior Range Examiner, at present working on M. F. degree, Harvard Forest, Petersham, Mass.	New England Sec.
Guernsey, William G. Univ. of Idaho, B. S. F., 1929.	Junior Forester, Potlatch Timber Protective Assoc., 618 Realty Bldg., Spokane, Wash.	Northern Rocky Mt. Sec.
Hankinson, Geo. H. 1/3 yr.—Forestry short course.	District Ranger, Lolo N. F., Tarkio, Mont.	Northern Rocky Mt. Sec.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Harris, Thomas H. Univ. of Calif., B. S. F., 1927. Univ. of Idaho, M. S. F., 1930.	Junior Forester, Blister Rust Control, 618 Realty Bldg., Spokane, Wash.	Northern Rocky Mt. Sec.
Hartson, Harley H. Univ. of Mont., 2½ yrs.	Senior Forest Ranger, Bitterroot N. F., Sula, Mont.	Northern Rocky Mt. Sec.
Henrichs, Ed. ½ year in forestry studies.	Senior Forest Ranger, District Ranger Kootenai N. F., Troy, Mont.	Northern Rocky Mt. Sec.
Higgins, H. W. Two years in forestry.	District Ranger, Nezperce Forest, Grangeville, Idaho.	Northern Rocky Mt. Sec.
Hillman, W. P. Univ. of Idaho. 2½ yrs.	Assist. Forest Supervisor, St. Joe N. F., St. Maries, Idaho.	Northern Rocky Mt. Sec.
Jost, Edwin J. Univ. of Mont., B. S. F., 1930.	Junior Forester, Forest Service, Missoula, Mont.	Northern Rocky Mt. Sec.
Kaufman, H. S. No technical training.	District Ranger, McLeod, Mont.	Northern Rocky Mt. Sec.
Kingsbury, Corydon D. N. Y. State.	District Forester, 33 W. Main St., Norwich, N. Y.	New York Sec.
Kouba, Theeodore F. Iowa State, B. S. F., 1926.	Federal Title Agent, Bureau of Plant Industry, State Capitol Annex, Madison, Wis.	Wisconsin Sec.
Krueger, Otto C. F. Univ. of Idaho, B. S. F., 1929.	Extension Forester, State of Idaho, 827 Lynn Ave., Moscow, Ida.	Northern Rocky Mt. Sec.
Leavitt, Roswell Univ. of Mont., B. S. F., 1930.	Junior Forester, U. S. F. Service, Dillon, Mont.	Northern Rocky Mt. Sec.
Lewis, Ernest F. No technical training.	General Foreman of Nurseries, N. Y. State Cons. Dept., 129 Maple Ave., Saratoga Springs, N. Y.	New York Sec.
MacGregor, C. A. No technical training.	Assistant Forest Supervisor, Selway N. F., Kooskia, Idaho.	Northern Rocky Mt. Sec.
MacKay, Edward No technical training.	Senior Forest Ranger, Lolo, Mont.	Northern Rocky Mt. Sec.
McLean, L. H. 3 yrs. forestry Univ. of Mont.	Principal Forest Ranger, Red Lodge, Mont.	Northern Rocky Mt. Sec.
McConnell, Earl Ranger course, 2 yrs., Univ. of Mont.	District Ranger, Nezperce Forest, Grangeville, Idaho.	Northern Rocky Mt. Sec.
Mardasheff, Ivan G. Imperial Inst. of Forestry, Russia; Yale Sch. of Forestry.	Timber Cruiser, International Paper Co., Panama City, Florida.	New England Sec.
Melichar, Charles Univ. of Mich., B. S. F., 1928; M. S. F., 1930.	Junior Forester, Ouachita N. F., Mena, Ark.	Ozark Sec.
Merrill, Lee Potter Univ. of Mont., B. S. F., 1928.	Univ. of Mont., Missoula, Mont.	Northern Rocky Mt. Sec.
Miller, Douglas R. Oregon State, B. S. F., 1928.	Junior Forester, Blister Rust Control, Spokane, Wash.	Northern Rocky Mt. Sec.
Minckler, Leon Sherwood N. Y. State, B. S. F. 1928. 1 yr. work on Ph. D.	Instructor N. Y. State, Syracuse, N. Y.	New York Sec.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Mullin, George B. P. N. Y. Ranger Sch.; Yale.	Superintendent, Yale Forest, New Haven, Conn.	New England Sec.
Nee, A. H. No technical training.	Senior Ranger, Gallatin Forest, Bozeman, Mont.	Northern Rocky Mt. Sec.
Olson, Arthur L. No technical training.	District Ranger, Beartooth N. F., Limestone, Mont.	Northern Rocky Mt. Sec.
Otter, Floyd Univ. of Idaho, B. S. F., 1929.	Instructor, Univ. of Idaho, Moscow, Idaho.	Northern Rocky Mt. Sec.
Peabody, Joseph L. No technical training.	District Forest Warden, Mass. Dept. of Cons., Winchendon, Mass.	New England Sec.
Pearson, Thomas V. B. Y. Univ., Provo, Utah.	Junior Adm. Officer, U. S. F. S., Ogden, Utah.	Intermountain Sec.
Powell, C. E. ½ yr. in forestry studies.	Senior Forest Ranger, Kootenai N. F., Rexford, Mont.	Northern Rocky Mt. Sec.
Price, H. H. Utah Agri., B. S., 1927; M. S., 1928.	Junior Range Examiner, Humboldt N. F., Elko, Nevada.	Intermountain Sec.
Ramsay, Marshall G. Study course given by Forest Service.	Senior Forest Ranger, Beaverhead N. F., Wisdom, Mont.	Northern Rocky Mt. Sec.
Redding, Hugh S. Univ. of Mont., Ranger short course. Senior in Sch. of Forestry, Univ. of Mont.	Senior Forest Ranger on L. W. O. P., Missoula, Mont.	Northern Rocky Mt. Sec.
Robb, Walter L. Ranger Sch., Univ. of Mont. 1 term.	Forest Ranger, U. S. F. S., Missoula, Mont.	Northern Rocky Mt. Sec.
Rudolph, Rosser A. Univ. of Mont., B. S. F., 1930.	Junior Forester, Fort Peck Indian Reservation, Fort Peck Agency, Poplar, Mont.	Northern Rocky Mt. Sec.
Schroeder, August A. Study course given by Forest Service.	Principal Forest Ranger, Dillon, Mont.	Northern Rocky Mt. Sec.
Schwarz, G. Victor N. Y. State, S. U.; B. S. F., 1928.	Forester, Delaware & Hudson R. R. Corp., Albany, N. Y.	New York Sec.
Shaner, Fred W. 2 yrs. Vocational training at Univ. of Idaho.	Senior Forest Ranger, Selway Forest, Kooskia, Idaho.	Northern Rocky Mt. Sec.
Shockley, Clyde W. No technical training.	Principal Forest Ranger, Bitterroot N. F., Darby, Mont.	Northern Rocky Mt. Sec.
Scribner, C. H. Short Course, Univ. of Idaho.	Forest Ranger, St. Joe Forest, St. Maries, Idaho.	Northern Rocky Mt. Sec.
Stewart, Geo. Dr. Utah Agric. Col., B. S., 1913; Cornell, M. S., 1918; Univ. of Minn., Ph. D., 1926.	Senior Ecologist, Intermountain Forest and Range Exp. Sta., Ogden, Utah.	Intermountain Sec.
Swan, Kenneth D. Harvard, B. A. S., 1909; Harvard Forest, M. F.	Public Relations Work District 1, Missoula, Mont.	Northern Rocky Mt. Sec.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Tennant, R. E. B. S. F., Univ. of Mont.	Forest Ranger, Bitterroot Forest, Darby, Mont.	Northern Rocky Mt. Sec.
Turney, George A. Iowa State, B. S. F., 1927; M. S. F., 1928.	Senior Forest Ranger, Wyoming N. F., Bedford, Wyoming.	Intermountain Sec.
Varner, Irvin Merle, Univ. of Idaho, 1 yr.	Senior Forest Ranger, Boise N. F., Pine, Idaho.	Intermountain Sec.
West, Vivian, No technical training.	Senior Ranger, Wasatch N. F., Pleasant Grove, Utah.	Intermountain Sec.

FOR ELECTION TO GRADE OF SENIOR MEMBER

Bowman, Arthur B. Penn. State, B. S. F. (Junior Member, 1930)	Junior Forester, Kootenai N. F., Libby, Mont.	Northern Rocky Mt. Sec.
Cobb, Francis E. Univ. of Minn., B. S. in Horticulture, 1916; M. F., Cornell Univ., 1925. (Junior Member, 1926)	President Sch. of Forestry, Univ. of N. Dakota, and State Forester, Bottineau, N. Dakota.	Northern Rocky Mt. Sec.
Hartman, Arthur W. Penn. State, B. S. F., 1913. (Junior Member, 1929)	Logging Engineer, Ouachita N. F., 122 Garland Ave., Hot Springs, Ark.	Ozark Sec.
Mattsson, C. A. Snow Normal College, L. D. S.; Business Col. Univ. of Utah, 1 Summer. (Junior Member, 1927)	Forest Supervisor, Fishlake N. F., Richfield, Utah.	Intermountain Sec.
Renner, F. G. Univ. of Wash., B. S. F.; 1 yr. Oregon State Col. on M. S. in Botany; 1 yr. Utah State Col. (Junior Member, 1927)	Intermountain Forest and Range Exp. Sta., Ogden, Utah.	Intermountain Sec.

W. G. HOWARD,
Member of Council in Charge of Admissions.

SOCIETY OFFICERS

Officers and Members of Executive Council

President, PAUL G. REDINGTON, Biological Survey, Washington, D. C.
Vice-President, JOHN D. GUTHRIE, Forest Service, Portland, Oregon.
Secretary-Treasurer, E. MORGAN PRYSE, Office of Indian Affairs, Washington, D. C.

Executive Council

The Executive Council consists of the above officers and the following members:

	Term expires		Term expires
R. Y. STUART	Dec. 31, 1931	CLIFTON D. HOWE	Dec. 31, 1933
ALDO LEOPOLD	Dec. 31, 1931	STUART B. SHOW	Dec. 31, 1933
T. T. MUNGER	Dec. 31, 1931	RALPH S. HOSMER	Dec. 31, 1933
W. G. HOWARD	Dec. 31, 1931	CLAUDE R. TILLOTSON	Dec. 31, 1933

Member in Charge of Admissions

W. G. HOWARD

Executive Officers

W. R. HINE, *Executive Secretary.* L. AUDREY WARREN, *Business Manager.*
810 Hill Bldg., Washington, D. C.

Editor, Journal of Forestry

EMANUEL FRITZ, 231 Giannini Hall, Berkeley, Calif.

Section Officers

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R. D. Forbes, Chairman, Allegheny Forest Exp. Sta., 3437 Woodland Ave., Philadelphia, Pa.
H. S. Newins, Vice-Chairman, State House, Charleston, W. Va.
H. F. Round, Secretary, Forester's Office, Pa. R. R. Co., Philadelphia, Pa.

Appalachian

Verne Rhoades, Chairman, P. O. Box 1346, Asheville, N. C.
C. F. Evans, Vice-Chairman, 223 Federal Bldg., Asheville, N. C.
W. K. Beichler, Secretary, 222 Federal Bldg., Asheville, N. C.

California

E. I. Kotok, Chairman, 332 Giannini Hall, Berkeley, Calif.
Woodbridge Metcalf, Vice-Chairman, 231 Giannini Hall, Berkeley, Calif.
M. R. Brundage, Secretary, 332 Giannini Hall, Berkeley, Calif.

Central Rocky Mountain

Allen S. Peck, Chairman, Forest Service, Denver, Colo.
John W. Spencer, Vice-Chairman, Forest Service, Denver, Colo.
J. A. Donery, Secretary, Forest Service, Denver, Colo.

Gulf States

E. A. Ziegler, Chairman, Southern Forest Experiment Sta., New Orleans, La.
Fred B. Merrill, Vice-Chairman, State Forester, Jackson, Miss.
A. R. Spillers, Secretary, U. S. Forest Service, New Orleans, La.

Intermountain

Earl C. Sanford, Chairman, Forest Service, Ogden, Utah.
T. G. Taylor, Vice-Chairman, Forest Service, Logan, Utah.
F. G. Renner, Secretary-Treasurer, Forest Service, Ogden, Utah.

Minnesota

R. N. Cunningham, Chairman, Lake States Forest Exp Sta., University Farm, St. Paul, Minn.
Raymond E. Stevens, Secretary-Treasurer, Minn. Land Economic Survey, University Farm, St. Paul, Minn.

New England

Austin F. Hawes, Chairman, State Forester, Hartford, Conn.
H. J. MacAloney, Secretary, Northeastern Forest Exp. Sta., Amherst, Mass.

New York

Arthur S. Hopkins, Chairman, Conservation Dept., Albany, N. Y.
H. C. Belyea, Secretary, College of Forestry, Syracuse, N. Y.

Northern Rocky Mountain

I. W. Cook, Chairman, University of Montana, Missoula, Mont.
S. N. Wyckoff, Vice-Chairman, U. S. Forest Service, Spokane, Wash.
I. V. Anderson, Secretary, U. S. Forest Service, Missoula, Mont.

North Pacific

R. H. Chapler, Chairman, Oregon Forest Fire Assoc., Porter Building, Portland, Ore.
Fred W. Cleator, Secretary-Treasurer, Box 4137, Portland, Ore.

Ohio Valley

E. M. Bruner, Chairman, 516 Federal Bldg., Louisville, Ky.
T. W. McKinley, Secretary-Treasurer, Isaac Bernheim Estate, Clermont, Ky

Ozark

George R. Phillips, Chairman, Oklahoma Forest Service, Oklahoma City, Okla.
A. C. Shaw, Vice-Chairman, U. S. Forest Service, Hot Springs, Ark.
Charles A. Gillett, Secretary, Extension Service, Little Rock, Ark.

Southeastern

Harry Lee Baker, Chairman, State Forester, Tallahassee, Fla.
H. A. Smith, Secretary, Asst. State Forester. Tallahassee, Fla.

Southwestern

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Stanley F. Wilson, Secretary, U. S. Forest Service, Albuquerque, N. Mex.

Washington

Ward Shepard, Chairman, 104 Leland Ave., Chevy Chase, Md.
F. W. Reed, Vice-Chairman, 3245 Cleveland Ave., N. W., Washington, D. C.
Alfred E. Fivaz, Secretary, Bureau Plant Industry, Washington, D. C.

Wisconsin

M. Y. Pillow, Chairman, Forest Products Laboratory, Madison, Wis.
C. J. Telford, Secretary, Forest Products Laboratory, Madison, Wis.